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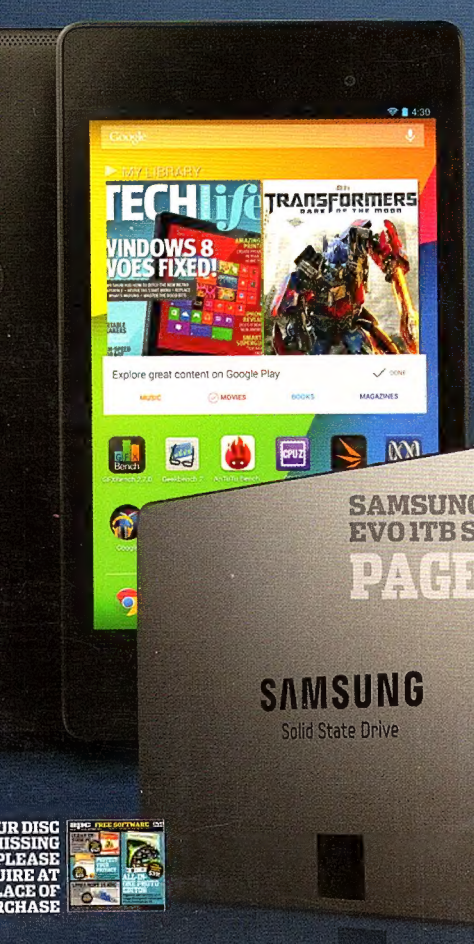

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+ WIN 8 'START' MENU REPLACEMENTS
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03 editorial

DAN GARDINER

Innovate or die

It's hard not to see Steve Ballmer's sudden announcement that he's stepping down as CEO of Microsoft as anything but an admission of failure. During his 13 years at the helm, Ballmer has had his fair share of successes, including the launch of Windows XP (which still holds a special place in many an older geek's heart), the creation and overwhelming success of Xbox as a product and brand, a successful comeback from the Vista debacle with Windows 7 and the continued dominance of Microsoft Office as the de facto software suite of most companies, both small and large.

But for every success Ballmer has had, there's almost always been an equally frustrating failure, with Windows 8 shaping up to be the latest one of those. (Almost a year in, uptake of Microsoft's newest OS has been slower than even Vista's. It currently sits at 5.4% of OS market share.) Many ex-Microsoft staffers have come forward over the years to chime in with their own opinions of where and why Microsoft has gone wrong – many have even dubbed the first 10 years of this century the company's 'lost decade'.

Whether Microsoft's problems are caused by a poisonous corporate culture, as is often the accusation, the root cause is fairly easy to pinpoint: the company couldn't innovate fast enough. There are similar stories across the tech landscape, Nokia and BlackBerry being two big companies who have found themselves in the same boat.

We're in a tech era where newcomers – and even some resurgent old-timers – who have been willing to both meet and drive change are now dictating where we're headed.

Well, for now at least. The great thing about innovation is that it doesn't have to involve massive design teams or be fuelled by deep pockets. In fact, in many ways those advantages often seem to be the enemy. Innovation almost inevitably involves risk and that's something that often puts smaller and more nimble companies at a distinct advantage. The cult followings behind the ultra-cheap Raspberry Pi and Arduino micro PCs that have emerged over the last couple of years are a great example. These aren't the latest glossy gadgets from a big brand, but they're still transforming the world by bringing tech and programming savvy to parts of the globe where higher-priced devices haven't been able to reach.

Welcome to the world of tech, where there rules are always the same: there's no room for reactionaries and the only constant is change.

Dan Gardiner

apc

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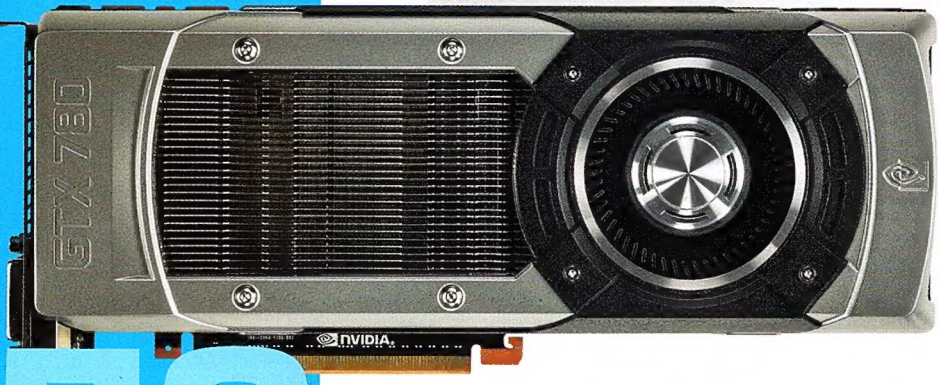

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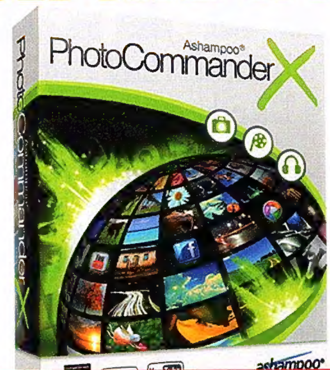

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WHICH NBN?

With the NBN one of the most contentious issues in this election, it's hard to know exactly what we'll end up with.

Broadband and communications policy was one of the hotly contested areas of the 2013 election, which was due to go to the polls shortly after our print deadline. As such, what version of the National Broadband Network we'll end up with was still up in the air. It can be tricky to untangle exactly what the differences are, however, so below we've included a quick rundown of what each one entails.

The most significant differences – and where many of the cost savings come from – are in the rollout of optical fibre, with Labor's plan going significantly further in this area and therefore costing significantly more. The Liberal plan is in parts constrained by the fact that the rollout is already well under way, which does create some disparity between new housing estates and existing premises in terms of connection speeds.

(Data courtesy of **theconversation.com/labor-and-coalition-broadband-policies-whats-the-difference-16165**.)

	COALITION	LABOR
Total cost of rollout	$29.5 billion	$44.1 billion
Installation	Optical fibre installed to local nodes ('fibre to the node' or FTTN); existing premises (71%) will be connected to these nodes via copper cabling, while new premises (such as in new housing estates, totalling 22%) will be connected via optical fibre. All other premises (7%) will be served by wireless or satellite services.	Optical fibre installed directly to 93% of homes and businesses ('fibre to the premises' or FTTP). All other premises (7%) served by wireless or satellite services.
Max speeds	Downloads: FTTN: 50Mbps, FTTP: 1Gbps, Wireless: 25Mbps, Satellite: 12Mbps. Uploads: FTTN: 10Mbps, FTTP: 400Mbps, Wireless/Satellite: 5Mbps.	Downloads: FTTP: 1Gbps, Wireless: 25Mbps, Satellite: 12Mbps. Uploads: FTTP: 400Mbps, Wireless/Satellite: 5Mbps.
Rollout completion date	2019	2021

Google Glass hasn't even hit the market yet and already the war against Apple is on.

THE IMPENDING SIRI vs. GOOGLE GLASS SHOWDOWN

The war of the assistants.

Digital personal assistants may be running all our lives in five years' time... well, that is if they haven't killed each other by then. Apple recently fired the first salvo in the inevitable Siri vs. Google Glass clash, with an updated Siri in iOS 6 now primed to provide snarky responses to questions relating to Google Glass.

Speak Glass's activation phrase "OK Glass" to your iPhone, for example, and you'll be curtly told that, "I think you've got the wrong assistant". The war has started folks... let's hope human casualties are kept to a minimum.

Apple's Siri digital assistant offers some smarty pants responses to Glass questions.

THE (A)PC REVOLUTION

OCT/2005

AMD vs INTEL CPU FACE-OFF

APC's Labs staff tried to see if they could cook an egg (inside a makeshift aluminium tray) directly on top of a big and hot Pentium 4 CPU. Did the staffers actually eat the resulting 'CPU egg sandwich' (made with two slices of pearly white bread and a dollop of BBQ sauce)? Some secrets are best left untold...

WINDOWS VISTA

Back before Vista was released, *APC* delved into an early beta build of the OS to whip up this story, billed as "the most extensive examination of XP's successor yet". Reading the feature's subheadings could perhaps have been a hint at what was to come: we described IE7 as 'underwhelming', the Glass GUI 'confusing' and the under-the-bonnet changes 'disappointments'.

THE TOP GAMING PCs

We often complain about how much we pay for our tech, but it's worth considering that back in 2005 the gaming PCs tested for this feature cost $4,000. Four of the six systems were AMD-based, with Athlon 64 X2 chips the order of the day, with 1GB of RAM and around 200-400GB of storage.

Initial sales of BlackBerry's new Z10 flagship handset were promising. What happened?

THE FALL OF A JUGGERNAUT

Is the writing on the wall for BlackBerry?

You don't have to look too far to see that times are tough for traditional tech companies. Over the last two months, former phone juggernaut BlackBerry has laid off its head of US sales, alongside 250 employees from its product testing and R&D departments, and a further 100 a month later. The cuts follow on from an estimated 3,000 staff who were let go last year, as the company seeks to "move our transformation forward in a timely manner". But the recent announcement that BlackBerry is up for sale won't do much to dispel the relative air of doom and gloom.

Things were looking up for BlackBerry earlier this year, with initially strong sales of its new touchscreen-based flagship Z10 handset. However, that initial surge had apparently dried up by July, with US retailers reportedly discounting the Z10 by up to 75% in an attempt to move stock. The recent release of the Q10 – a combo touchscreen/physical-keyboard phone that we reviewed in *APC* September (see page 35) doesn't seem to have turned that sales trend around, which have been varying described by analysts using terms from 'bleak' to 'abysmal'.

Many *APC* readers will likely have a soft spot for BlackBerry and it rightly deserves a place in the tech hall of fame as the first phone that really got mobile email right. Past glories aren't worth much in the tech sphere, though, and the fall of BlackBerry is another important indicator that in tech, the core rule is still 'innovate or die'. We guess the big question is who'll be the next giant to fall?

KICKSTARTER COMES TO AUSTRALIA

Aussies will soon be able to launch their own crowdfunding campaigns.

Crowdfunding is one of the most disruptive trends to come from the web in the last five years, revolutionising the way products (both physical and digital) are made and sold. Thus far, however, the company has only been legally set up to allow campaigns in the US and the UK (using either US dollars or UK pounds), with a Canadian rollout planned for September. It turns out that an official Australian launch isn't too far away either – the company is hosting sessions for prospective project starters in September.

Of course, Australians have been able to back Kickstarter campaigns since the site opened in 2009 and they've been able to create projects on the overseas sites to a limited extent. But the launch of an official local edition should mean we start to see a lot more Australian innovations able to be presented to the world stage. It could be time to pull your finger out and finish the prototype for those rat-powered rollerskates you've been designing...

KICKSTARTER

NUMBER CRUNCH

48,000

NUMBER OF APPS AVAILABLE FROM ONE DEVELOPER ON BLACKBERRY WORLD (APPROX.)

On some app stores, you might be considered a 'big time' developer if you have, say, 10 apps or more for sale. Even a handful of programs suggests significant development time. But over on BlackBerry World, one Hong Kong-based developer, S4BB, accounts for a *whole quarter* of the entire app catalogue for BlackBerry users, totalling a somewhat unbelievable 48,000 or so programs – the vast majority of these are seemingly city guides. So if you ever need to find your way around Aappilattoq (population 132, in Greenland, in case you didn't know), now you know who's got you covered.

1+1=THREE

XEROX CONFIRMS SOFTWARE BUG CAUSES SCANNERS TO RANDOMLY MIX UP NUMBERS IN SCANNED DOCUMENTS

Truly one of the weirdest bugs we at *APC* have ever heard of: a subset of Xerox multifunction printers have been found to randomly substitute numbers in scanned documents. The hard-to-find yet very real software error presents itself when sufficiently small font sizes confuse the scanner, causing it to effectively guess at what the figures might be. That's not very reassuring, is it? The company has since released a patch, although affected users might just want to check over their scanned tax returns, payslips, bank statements and so on for the last couple of years...

US$1,400

COST OF MAKERBOT'S NEW DIGITIZER, A 3D SCANNER FOR PHYSICAL OBJECTS

Offering further irrefutable proof that personal technology is increasingly resembling something out of a *Star Trek* episode, MakerBot is now selling its Digitizer 3D scanner, which uses a pair of lasers to scan small physical objects, creating a digital 3D model of your piggy bank, lunch box or coffee cup as required, which can then be shared, modified and 3D printed. The future is upon us and it looks like it will be full of novelty figurines.

10 GIGABYTES

FREE CLOUD STORAGE NOW PROVIDED BY BOX

The online storage market is continuing to bulk up, with Box recently doubling its free amount of cloud storage for personal users to a handy 10GB, making it now five times larger than rival Dropbox's rather measly free 2GB offering. Admittedly, though, Dropbox provides a number of easy ways to bump up your storage at no cost, provided you're happy to spam your friends. Still, the most astounding free storage deal on offer remains Flickr's: 1TB of free photo storage for whoever wants it. But how long will that take to upload?

2,560 x 1,440

Resolution of world's first Quad HD smartphone display

It's just been officially confirmed, folks: the resolution wars will never end. Today's Full HD or Retina is inevitably destined to become yesteryear's hero, just another VGA on the low-res pixel heap. The latest evidence of this is LG's new Quad HD panel, a 5.5-inch smartphone display that provides 2,560 x 1,440 at a squint-tastic 538 pixels per inch. The next step will inevitably be 4K/UHD mobiles (3,840 x 2,160), making us all soundly regret rushing out to buy our now outdated Quad HD phones.

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10 gadgets

BY GOLDIE HONG

Samsung Galaxy S4 Zoom

If for some weird reason you're not entirely satisfied with the 13MP camera your S4 packs, Samsung has just released its brand spankin' new Galaxy S4 Zoom, which ups the MP to a pretty solid 16. Now, we're not sure if this is primarily an Android-powered smartphone with an advanced still and video camera, or the other way round, but Samsung reckons it's a balanced mashup of the two. With just a twist of the Zoom's front-mounted zoom ring, followed by a quick touch of the display, you can choose from a range of modes such as Auto, Gallery, Smart Mode, Manual and the all-new 'My mode'. The camera also features 10x optical zoom, optical image stablisation, a 4.3-inch super AMOLED capacitive display and Corning Gorilla Glass 3 protection. We've found the Zoom going for around $499 if you hunt online.

ONLINE: www.samsung.com/au

Lenovo Miix 10

'An affordable mix of Windows 8 tablet and laptop PC', Lenovo has said of its newest tablet, dubbed the Miix 10. It's a 10.1-inch device with a 1,366 x 768-pixel IPS display. An Intel Atom processor is packed inside so the Miix can be attached to an optional keyboard case with integrated AccuType keyboard to instantaneously convert it to a laptop. Therefore, its ability to switch between tablet and laptop modes should make it ideal for on-the-go entertainment or productivity. With near-180° wide viewing angles and a 1MP HD front camera for video chat and conferences – all at a very reasonable price point – the Miix 10 is the more affordable alternative to the $2,500 11.6-inch ThinkPad Helium ultrabook convertible tablet PC.

ONLINE: www.lenovo.com

Logitech UE Boom

Boom! Shake, shake, shake the room. Indeed, the UE Boom probably will, what with its 360° speakers, dual performance drivers and dual passive radiators to emphasise deep, low frequencies. Pair it with your Bluetooth device (the Boom can be paired with two Bluetooth-enabled devices) to switch songs, adjust volume or answer phone calls from up to 15m away. The plasma coating makes it water- and stain-resistant, and it has a reported 15-hour battery life. We love that the Boom is available in six eccentric and stylish colours, and just looking at it makes us feel pretty happy already. Just as a quirky fun fact about the Boom: its design is based on a water bottle, hence the shape and size may have reminded you of that ordinary H2O-carrying object.

ONLINE: www.ultimateears.com

GX Gaming Manticore

Featuring mechanical-like keys, a whopping 16 million colour RGB backlight palette and four brightness levels to choose from, the Manticore by gaming peripheral maker Genius is an expert-grade gaming keyboard. The keyboard also features eight programmable macro keys on the left-hand side, which allows gamers to assign up to 24 macros where they can alternate between three different profiles with just a press of a button. A dedicated 'Master Record' key also enables gamers to record and allocate macros on the fly. Handily, the 20 anti-ghost keys can be pressed simultaneously without any impeding ghosting effect. The Manticore boasts an impressive 1,000Hz report rate with a super-fast 1ms response time, 32KB of onboard memory and is outfitted with rubber pads on the base for superior stability.

ONLINE: www.gx-gaming.com

Virtuix Omni

Imagine being able to walk around *in* your favourite video game. For me, I'd love to take a casual stroll through *Borderlands 2*'s 'Sanctuary' – I mean, after all, that place felt like a second home to me for a while (47.1 hours, to be exact). Wouldn't that just be the shiz? Well, wait no more because the Kickstarter-backed Virtuix Omni gaming treadmill is available for pre-order now. It allows anyone to traverse virtual worlds just by walking, running or jumping on the treadmill and is designed to be used in conjunction with a head-mounted virtual reality display such as the Oculus Rift, supporting PC games that utilise keyboard input for movement control. For the princely sum of US$499, you'll get the Natural Motion Interface package, which includes the platform, shoes, belt and tracking hardware and software so that you can wander about in your favourite virtual reality. Totally cool.

ONLINE: www.virtuix.com

TomTom GO

The newest GO range of GPSs from TomTom has undergone a complete redesign – along with a significant price drop – to bring you two new models in the GO 500 and 600. The 500 is a standard 5-inch model and the 600 features a fairly large 6-inch touchscreen. You can now see buildings and landmarks in 3D with the brand-new 3D maps feature, connect your smartphone to the GPS via Bluetooth to access TomTom Traffic and simply 'Tap & Go' (tap the map to get moving faster rather than searching via a generic menu). As with the previous GO LIVE range, you'll still get advanced lane guidance, QuickGPSfix for faster recalibration and the Lifetimes Maps service, so you'll always be up to date with the latest maps. See page 29 for our full review of the GO 600.

ONLINE: www.tomtom.com

Glorious gaming on the go with the Iris Pro, but it ain't cheap.

FEATURE

HANDS ON WITH INTEL'S IRIS PRO

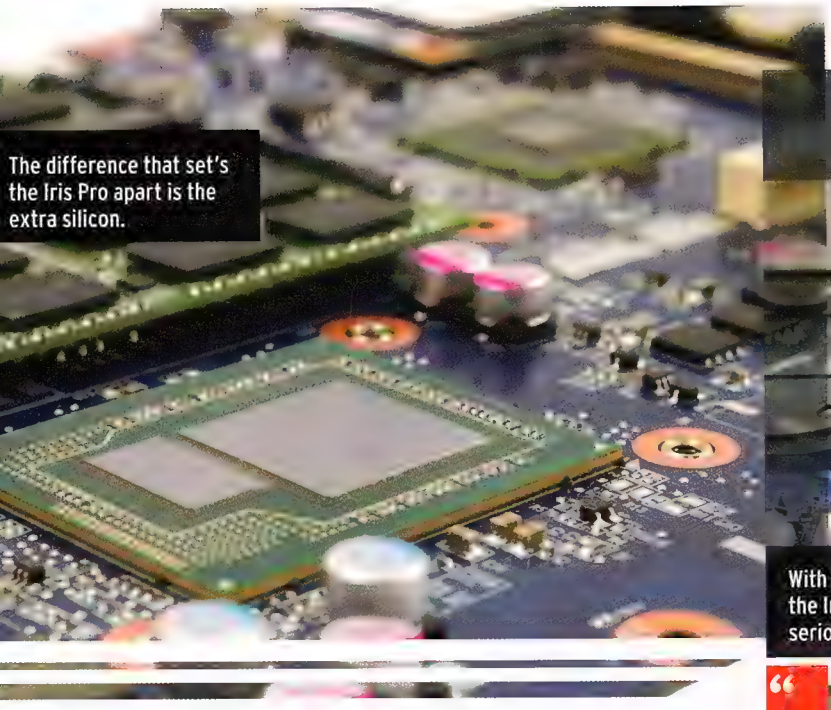
Strapping on his benchmarking belt, Dave James goes in search of a mythical beast: the fabled Iris Pro...

Beefy processor, low power demands and serious graphical chops – this was always the promise of Intel's Fourth-Generation Core architecture. Haswell's top-end Iris Pro iGPU has been held up as the integrated graphics processor we've always wanted, with "GT3e" whispered in hushed tones behind the scenes at Intel Developer Forums past. Now I've spent some quality time with Intel's impressive mobile powerhouse, I most definitely want my own, but I'm probably never going to get one.

For me it was a huge disappointment that we didn't get to see an Iris Pro-based CPU at the launch of Intel's Fourth-Gen Core architecture. When Haswell dropped into our Labs in desktop trim, it did so with a resounding 'meh'. It's not that it's a bad architecture – far from it – but it wasn't moving things along from the previous generation, and the focus on improved graphics performance and lower power draw was irrelevant in the desktop parts we had from the get-go.

If Intel had supplied us with a whitebook rocking an i7-4750HQ at Haswell's launch – like the machine I found myself benching deep inside Inte's local HQ – I'm confident much of our apathy towards the architecture would have been offset by the performance of this particular 47W part.

But let's not get ahead of ourselves here. First things first: what exactly is the Iris Pro? In an effort to simplify the naming of Intel's



The difference that set's the Iris Pro apart is the extra silicon.

With the right settings, the Iris Pro has some serious gaming chops.

graphics tiers, it added in another name for its higher-end parts. The bottom end of the ladder is simply known as Intel HD Graphics, with the next step up running with the HD 4x00 nomenclature. From there we're into the more serious Haswell HD 5000 graphics parts, hitting a full 40 execution units – effectively, that's similar to unified shaders. From there up we've got the top table: the new Iris 5100 and Iris Pro 5200 graphics.

SIMPLIFY

OK, so it's still not that simple, but essentially, if you're looking for the very top of Intel graphics tree, you're looking for Iris Pro. The difference between HD 5000 and Iris 5100 is purely clock speed; the difference between the Iris 5100 graphics and Iris Pro 5200, though, is about the extra silicon Intel has paired with it.

Iris Pro gets a new level of cache to be shared between the CPU and GPU – a full 128MB of eDRAM, codenamed Crystal Well. This is designed to shore up the disparity between the pedestrian memory interfaces of standard CPU parts and the high-speed interfaces that proper discrete graphics chips call their own. On top of a peak theoretical bandwidth of 26GB/s with the 128-bit DDR3 interface, the eDRAM adds another 50GB/s. When the top SKU of the similarly-powered Nvidia GT 750M offers some 80GB/s of memory bandwidth, it's clear that Iris Pro is really catching up with discrete mobile GPUs.

In fact, if you check out the GFLOPs rating of the Iris Pro versus the GT 750M, Intel actually steals a march on its discrete rivals. It's around 743 GFLOPs against the Iris Pro's 832 GFLOPs. However, all this doesn't necessarily translate into real-world performance gains for Intel – we're talking about completely different architectures and driver sets.

So how does Iris Pro perform when you jam it into a fully-fledged laptop and throw some benchmarks down its game tubes? To find out, I spent the day at Intel UK's Swindon fortress testing a whitebook Clevo W740SU housing the i7-4750HQ Haswell. That's got the all-important Iris Pro 5200 graphics humming away inside. This isn't the very top end of the Iris Pro range, coming with a 1.2GHz clock speed on the GPU part compared with the 1.3GHz of the top i7-4950HQ chip.

Still, this is a bona fide quad-core Fourth-Gen Core chip with eight threads and a base clock speed of 2GHz, Turboing up to 3.2GHz if you let it. With a little light overclocking, you can easily hit 1.3GHz with the graphics, too. As well as the chip I came to see, it's also got a quite lovely 14-inch 1080p IPS panel and a chassis that would have counted as an Ultrabook of the last generation.

In terms of processor benchmarks, it's competitive with both the i7-4800MQ and i7-4700MQ, but will annihilate them when you start talking graphics. The HD 4600 offers half the frame rate of the Iris Pro's 40 EUs and 128MB of eDRAM. That said, my initial benchmark numbers with the top Haswell graphics still left me feeling a little disappointed.

> From what we've seen, it's clear that the Iris Pro is really catching up with discrete mobile GPUs

ULTRABOOK GAMING

At my standard benchmark settings (throw the settings up and watch the silicon bleed...), I was getting less than 10fps in *BioShock Infinite* and Heaven 4.0, and around 16fps in *DiRT Showdown*, all at the screen's native resolution of 1,920 x 1,080. Those chip-stressing benchmarks are great for comparing performance with other GPUs and laptops, but they don't really tell us a lot about the level of gaming you'll get from the Iris Pro in the real world.

Running my benchmarks at the highest graphical settings, with 4x antialiasing thrown in, is a mite unfair for even the Iris Pro integrated graphics. With the tiny pixels of the full HD IPS panel though, AA is a luxury we can happily ignore. By dropping the overall settings down a notch or two, you can get some seriously playable performance out of this diminutive machine.

Starting from the view of current-gen console titles – namely, no antialiasing, 720p resolutions and 'high' settings – I was able to hit a massive 38fps in *BioShock Infinite*. It still looks fantastic at those settings and absolutely flies. This is serious gaming on a machine that's drawing just 74W from the plug, all told. In a quad-core laptop, a 50W GT 750M and a 37-47W CPU are going to top that by themselves. However, you're going to need some pretty hefty cooling to be able to cope with that pairing, which will affect the sort of form factor it can fit in, too.

So, Iris Pro will give you a svelte laptop capable of unprecedented gaming, but unfortunately, we're going to find them tricky to track down. In Europe, Schenker is selling the same Clevo machine for over €1,000. Clevo sellers elsewhere struggle to see the value, given there's no saving over a machine with a discrete GPU.

Form factor is the key for Iris Pro, but you'll have to pay for it. Oddly enough, the one company for whom price doesn't matter is Apple. Its new MacBook Pro is likely to be your best option for getting your hands on Iris Pro. Weird. APC

14 epinions

HAVE YOUR SAY

DON'T BE RUDE

Not everyone appreciates a smart arse.

I wish to take issue with the comments in reply to the 'Flashing dialogues' question in the August issue ('Quick tips', page 72). Just because Steve James mentioned Mahjong Titans, the 'expert tipper' found it hard to believe that Steve actually played the game, found it 'unforgivable' and suggested he find better games to play. The tipper also suggested that the Windows bundled games were the 'worst use of your time'. Oh dear. And other games are a better use of our time? The tipper's comments were actually unforgivable. I hope APC treats its readers more respectfully in future, otherwise I may become an ex-reader.

Jim Sharples

Editor replies: *Point taken Jim. The response was meant purely in jest (we'll admit that* Mahjong Titans *really isn't* that bad*), but we can see how that sense of humour wouldn't be to everyone's tastes.*

Like any piece of hardware, it's a good idea to update your SSD to the latest drivers.

UPDATE SSD DRIVERS

I had similar issue to Max Andersen ('HDD bootup fix', *APC* September, page 18) with my OCZ Vertex 4 SSD and ASUS motherboard. It rarely cold booted – it always failed and needed a reboot, otherwise the SSD needed to be re-enabled in the BIOS to boot.

I upgraded firmware for the SSD and it's been all good since then. At work I subscribe to HP updates for a number of our supported models and there are heaps more updates available for SSDs compared to any other device.

Greg Keegan

NO NEED TO UNPLUG

I've just finished reading the September issue of *APC* and greatly enjoyed the cover story on guarding your privacy after all the recent hubub over NSA spying.

I'm someone who does like to safeguard their privacy, but I'm not such a stickler as to go through every EULA with a fine-toothed comb before deciding to click 'Accept'. There's obviously a trade-off we have to make between security and privacy and depite the US government calling him a criminal, I don't think anyone could argue that Edward Snowden hasn't done some good by opening up the subject for debate. A greater level of transparency when dealing with the data of civilians – not matter where they might live in the world – is something that I'd like to see.

Getting back to the article, I found it very thorough – though it might take me some time to work my way through all the recommendations!

Thanks again for the great mag – and keep up the great work!

Bill Short

The Babylon 10 translator is nasty and can hijack your browser.

HIJACK WARNING

I have previously read an article in *APC* on the removal of Babylon Toolbar, including the extent of the hijacking it does. A local college is offering the Babylon 10 free translator to its students. I informed the teacher and course director of Babylon's potential problems. But it remains on the web site.

And now, despite me warning them, they are telling students to think up five phrases and use Babylon to translate them as part of the course requirements. There will soon be a lot of very annoyed students in their course and the teachers can't plead ignorance, as I have previously informed them of the dangers of Babylon.

Gordon Dalziel

APCMAG@FUTURENET.COM

Come on, have your say!

We want to hear what you think. Add to these discussions or email your views (in fewer than 250 words) to apcmag@futurenet.com. All correspondence becomes the property of *APC* and is subject to editing. Letters must include full name, street address, suburb, state and phone number to be considered for print publication. Address and phone details will not be published.

MOBILE MELTDOWN

You get what you pay for. Or do you? The dramatic fall of telco reseller shows that not everything is what it seems in Australia's mobile marketplace.

When online retailer and media provocateur Ruslan Kogan announced the launch of Kogan Mobile in December 2012, it was framed in his typical trash-talking, headline-grabbing style. In a PR release brazenly entitled 'Kogan rescues Australians from mobile madness', the Kogan founder announced he would provide Telstra's mobile network at unprecedentedly low prices for the benefit of the Aussie mobile user, "offering the best deals on mobile services ever offered in the country".

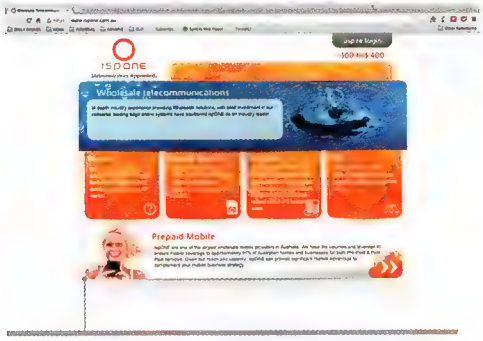
While on one hand boasting that Kogan Mobile would be "the first Australian mobile provider to use part of Telstra's Mobile Network for prepaid mobile services", Kogan simultaneously blasted the back-end proprietor of his newly minted venture, crying: "It's a disgrace that *current providers* [ie. Telstra, Optus and Vodafone] have been able to get away with astronomical charges, network issues, poor customer service, frustrating excuses and deliberately misleading pricing structures designed to trip customers up." (Emphasis added.)

A certain adage about not biting the hand that feeds you springs to mind and perhaps with good reason: less than a year later, approximately a quarter of a million Australian mobile customers across Kogan Mobile and Aldi Mobile's networks – both reliant on middleman Telstra reseller, ispONE – were being threatened with affected and cut-off service. What went wrong?

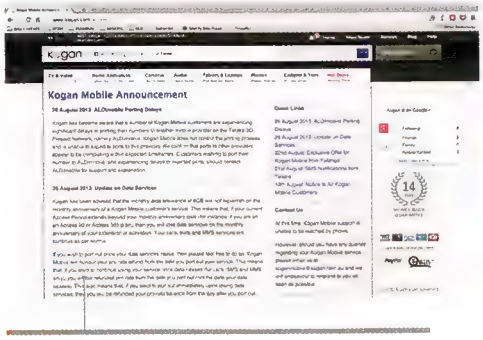
If you can read between the lines of conflicting PR spin since issued by many of the vendors involved, the crucial meltdown seems to lie with the financial pressures being exerted on ispONE, which was increasingly and unsustainably sandwiched between its arrangements with Telstra (whose network it was on-selling) and its conflicting deals with Kogan and Aldi. According to reports, ispONE was buying Telstra's network at volume rates for calls and data, but then on-selling to Kogan Mobile at a per-subscriber rate. Inevitably this pivotal mismatch caused revenue problems – especially with Kogan endlessly promoting 'Unlimited' services to all and sundry – resulting in a widely publicised legal battle between Kogan and ispONE in April.

Ultimately, the pressures and the losses became too much, and in August ispONE entered voluntary administration, putting the mobile accounts of some 250,000 Australians (120,000 users on Kogan Mobile, 130,000 with Aldi Mobile) at risk. While Aldi successfully negotiated a first-hand arrangement with Telstra to carry on services to its customers, Kogan Mobile wasn't so lucky. After an interim period, Kogan customers are obliged to transfer their number to another provider. It's a far cry from 'Kogan rescues Australians from mobile madness'. If anything, it's the opposite.

From an end user's perspective, what can be learned from the ispONE saga, given some *APC* readers would inevitably have been caught in the crossfire? Perhaps the biggest lesson is that with increased savings comes increased risk. While top-tier mobile networks like Telstra and Optus might come with a significant price premium over what resellers (aka MVNOs, mobile virtual network operators) are offering, they're selling you access to their networks directly and with first-hand knowledge of pricing that's sustainable. Once you try to save a buck and step outside that arrangement, things get more complex, less clear cut and less safe. And sometimes, with a little bad luck and a lot of mismanagement, they'll fall down. APC



ispONE's web site is still up and looks like it's open for business as usual, but look a little closer and you'll notice one important little difference under the logo: 'Administrators Appointed'.



Kogan Mobile's home page used to display wall-to-wall marketing bluster about unbeatable deals and value. Now it's plastered in updates and announcements trying to assist cut-off customers.

Compared to Kogan Mobile customers, users of Aldi's Mobile service got off lucky, with the German retail giant managing to secure a safety net deal with Telstra on behalf of its affected customers.

ENDUSER

Share the hilarity!

Do you work in the IT industry and are forced to deal with inept and clueless end users on a daily basis? Do you have an IT professional, who isn't that 'professional'? If you have an interesting or amusing story, email us at apcmag@futurenet.com. All correspondence becomes the property of *APC* and is subject to editing. Letters must include writer's full name, street address, suburb, state and phone number to be considered for print publication. Address and phone details will not be published.

GEAR

OCULUS RIFT

We take a look inside the VR head-mounted display.

BACKGROUND

The Oculus Rift promises gamers a virtual reality experience that will make all other 'immersion' tactics seem, well, one-dimensional. The wearable display with head tracking isn't available for consumers yet, but we took apart a developer edition to get a gander of what's inside.

MAJOR TECH SPECS

While not much is known in terms of tech specs, here's what we've gathered so far.

- Resolution of 1,280 x 800 pixels, 640 x 800 per eye.
- Horizontal field of view is greater than 90°.
- Diagonal field of view is greater than 110°.
- Head tracking accomplished with 1,000Hz absolute 9DOF orientation sensor (includes gyroscope, accelerometer, and magnetometer).
- Control box for connecting Oculus Rift to a PC.

KEY FINDINGS

- Separating the display from the strap assembly requires just a Phillips #1 bit. (Does the fact that this isn't the final production have anything to do with it being easy to take apart? Perhaps – only time will tell.)
- After easily separating the two sides of the lens cowling with a plastic opening tool, we get our first unobstructed look at the 1,280 x 800 LCD.
- A couple of clips and some sticky foam adhesive hold the display securely into the front panel of the Oculus. Disconnecting one cable from the display assembly allows complete removal of the Innolux HJ070IA-02D 7-inch LCD.
- The final component out of the headset is the Oculus Tracker V2 board, custom-designed and optimised for a 1,000Hz refresh rate. Here we find the chips controlling the revolutionary head-tracking device: STMicroelectronics 32F103C8 ARM Cortex-M3 microcontroller with 72MHz CPU, Invensense MPU-6000 six-axis (gyro and accelerometer) motion-tracking controller, A983 2206 – we suspect this is a three-axis magnetometer, used in conjunction with the accelerometer to correct for gyroscope drift.
- The Development Kit control box is pretty basic, consisting of buttons for adjusting the Rift's settings and a handful of I/O ports. It opens up after removing four Phillips #1 screws and reveals a Realtek RTD2486AD display interface controller, Winbond W25X20CL 256KB serial flash and Techcode TD1484A synchronous rectified step-down converter.
- Standard Phillips #1 coarse-thread screws are used in both the headset and control box, making them a cinch to open. Standard clips around the perimeter make separating the front panel pretty easy and the entire device can be taken apart in less than 10 minutes. abc

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EDITOR'S apc CHOICE

SAMSUNG 840 EVO 1TB

9/10

High capacity and high performance — SSDs have come of age.

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$789 $

Stupidly capacious, excellent random read performance. ✔

It'll cost ya. ✖

We've been waiting for our 2.5-inch SSDs to hit the 1TB mark for years and now two have come along pretty much at once. OK, Crucial's 960GB M500 managed to nail the 'terabyte-class' moniker first, but Samsung's is the first drive to actually have '1TB' emblazoned on the box.

The 840 EVO represents a new range for Samsung's 840 series drives, but despite offering some seriously impressive performance metrics – particularly in the random 4K department – the EVO lineup isn't replacing the top 840 Pro series. No, this is where the standard 840 drives bow out, leaving the EVO the consumer-class range below the Pros, with prices to match.

The EVO's performance is still thoroughly impressive for a consumer-class SSD and that headline-grabbing capacity could be all the storage you need in your PC. And unlike every other SSD manufacturer out there, Samsung is basically going it alone, with pretty much every single component in the 840 EVO manufactured by Samsung itself. That gives the South Korean company the ability to price its drives incredibly aggressively. This 1TB drive has managed to hit the 79c/GB mark and the fact that not so long ago we were excited about that getting under the $1.80/GB point shows what rapid progress the SSD market is making.

The use of 3-bit MLC memory is also helping drive down the cost. The 3-bit MLC (previously referred to as triple-level cell or TLC) enables higher-capacity drives without breaking the bank. The 2-bit MLC in the Pro series has more longevity and some extra performance chops, but Samsung has done some smart work with the EVO drives to ensure they're still the quickest SSDs you can pick up today in general usage.

The performance of these EVO drives is actually pretty astounding. Inevitably, the sequential read and write speeds are held back by the rapidly geriatric-looking SATA 6Gbps interface at 515MB/s and 503MB/s, respectively. This is the same with most modern SSDs and you'll notice that every manufacturer's drives are bunching up around the same transfer rates.

However, the random 4K performance is nowhere near saturating the theoretical 600MB/s limit that shackles the current SATA interface and this is where the 840 EVO scores a home run. The EVO is the current king of random performance, with the new, quicker MEX controller essentially doubling what the previous fastest drives were capable of. We've seen some drives capable of knocking around 55MB/s for random 4K writes, but the 840 EVO manages a class-leading 110MB/s. It's a similar story on random 4K read speeds, too, with the quickest drives hitting the mid-20s and the EVO reporting 41MB/s.

The only slight problem here is that one of the previous fastest drives was Samsung's own 840 Pro, which is still billed as the top of its SSD range. The reason that placing still works is because the EVO is using a new write acceleration algorithm known as TurboWrite in order to achieve some of its beefier performance scores. On the other hand, the Pro is capable of these sequential speeds no matter what.

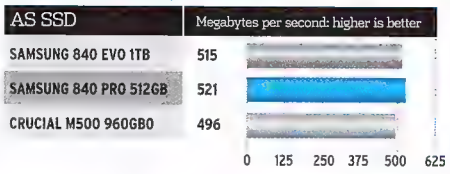
Regardless of the EVO's software bundle offering, though, the performance of the hardware on its own is enough for us to be excited about the new range. On top of the new drive capacities (debuting 750GB and 1TB drives) and aggressive pricing (the 120GB EVO is only $129), that random performance really puts the icing on this solid-state cake.

Crucial's 960GB M500 may just have the edge in terms of pricing, offering 'terabyte-class' drives with a slightly more modest tag than this hefty EVO SSD, but when it comes to performance, Samsung has it in spades. And it's performance where it matters, not just in headline-grabbing peak speeds. The 840 EVO is the most responsive solid-state drive we've tested and with such a large variety of capacities, there's a drive here for practically everyone.

Dave James

LABS BENCHMARKS

Sequential read performance


AS SSD
Megabytes per second: higher is better
SAMSUNG 840 EVO 1TB 515
SAMSUNG 840 PRO 512GB 521
CRUCIAL M500 960GB0 496
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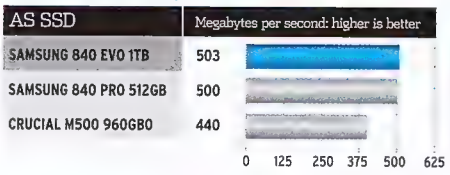
Sequential write performance


AS SSD
Megabytes per second: higher is better
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SAMSUNG 840 PRO 512GB 500
CRUCIAL M500 960GB0 440
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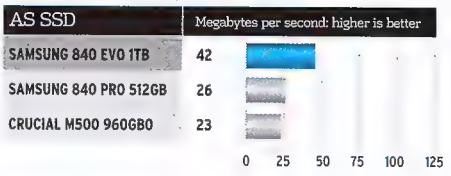
4K random read performance


AS SSD
Megabytes per second: higher is better
SAMSUNG 840 EVO 1TB 42
SAMSUNG 840 PRO 512GB 26
CRUCIAL M500 960GB0 23
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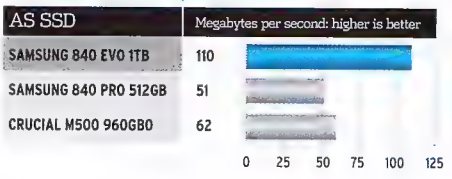
4K random write performance


AS SSD
Megabytes per second: higher is better
SAMSUNG 840 EVO 1TB 110
SAMSUNG 840 PRO 512GB 51
CRUCIAL M500 960GB0 62
0 25 50 75 100 125

8/10

CRUCIAL M500 960GB

The Crucial difference between this and the EVO? Pure performance.

SSD

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Lots of SSD at a (comparatively) reasonable price. ✓

Outperformed by the Samsung EVO. ✖

Welcome, dear reader, to the clash of the terabytes. In the pit today with Samsung's 840 EVO is this, the biggest of Crucial's M500 range. How does it stand up against the awesome might of the Samsung behemoth?

In the coming years – or, given how fast the SSD market moves these days, the coming months – the 960GB M500 might well come to be seen as a line in the sand. This was the first truly affordable, truly high-capacity 2.5-inch SSD available for a price that wasn't going to tear your wallet asunder. Well OK, $749 is still an eye-watering price tag, but given how much solid-state drives cost even a year ago, it's an impressively low price point.

The reason Crucial can offer such a large-capacity disk at this price is solely down to the NAND it uses. Up until now, the densest NAND found in SSDs has been of the 64Gb (8GB) variety. Crucial, or rather its parent company Micron, has been able to double this, making the M500 series the first to use 128Gb (16GB) 2-bit 20nm MLC dies. Moving to a larger die enables a decrease in the number of chips needed to reach a given capacity. This lowers the manufacturing cost of the drives, while simultaneously making them bigger.

At the heart of the drive is a Marvell 9187 eight NAND channel controller. Both it and the custom Crucial firmware are updates of the 9174 controller/firmware used in the previous-generation M4 drives. The firmware supports the latest ONFI (Open NAND Flash Interface) 3.0 standard. That brings with it power-saving features and more importantly from a performance point of view, an increase in the interface speed to 400MB/s (double that of the previous 2.0 standard).

Each NAND package in the M500 is made up of four of those 16GB dies, with the total capacity then made up of 16 64GB NAND chips (eight per side of the PCB). Joining the NAND on one side of the board is its Marvell memory controller and a 512MB DDR3-1600 cache chip, while on the other side of the board there's a matching 512MB RAM chip to make up the total cache.

Although the drive's true capacity is actually 1,024GB, Micron has used the proprietary RAIN (Redundant Array of Independent NAND) technology from its enterprise drives. This is essentially its version of over-provisioning and looks to take care of any failed NAND and increase reliability. However, this does eat up some of the drive's overall capacity, hence the 960GB label.

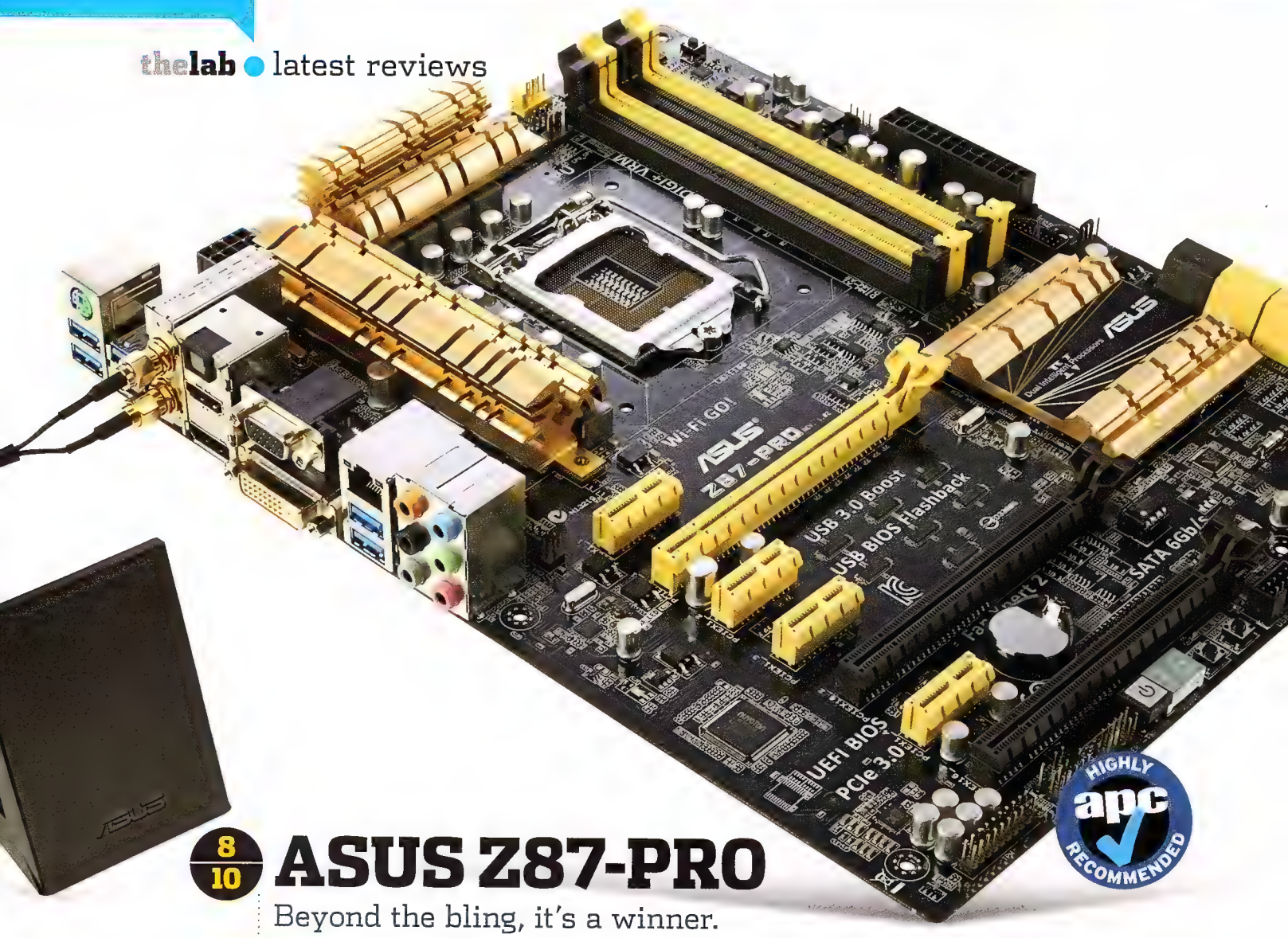
Crucial has added a good number of other features to the M500 series, all of which are more likely to be found in the enterprise space, including their own built-in power backups, so if the power should fail, the drive will finish any writing duties as long as the data is in the NAND. There are also thermal controls, so if the drive goes above 70°C, it will throttle back by around 40% until it returns to a stable working temperature.

Crucial quotes sequential read speeds for this 960GB drive of up to 500MB/s, while the sequential write speed is quoted at 400MB/s. Both of these turned out to be a tad conservative when compared with the results of the ATTO benchmark – 541MB/s for sequential reads and 454MB/s for writes.

Synthetic benchmark scores are all well and good, but what about real-life performance? Installing Microsoft Office took a mere 5 minutes and copying a 50GB folder of mixed file sizes and types took 4.5 minutes. Copying a 4GB image took a fairly brisk 20 seconds and the drive took 83 seconds to copy a 17GB Blu-ray image.

Those are great results, but ultimately, the new Samsung 840 EVO 1TB drive is still a little further in front. The EVO might be slightly pricier if you want a drive that's 'terabyte class', but it's got this Crucial drive beat where it counts: in performance terms. The M500 doesn't need any TurboWrite-esque shenanigans to maintain its performance, but in this class of drive, it's still difficult to look past the superior Samsung EVO.

Simon Crisp



8/10 ASUS Z87-PRO

Beyond the bling, it's a winner.

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www.asus.com.au @

$280 $

Good overclocking options, ATX form factor, good overall performance. ✔

Gaudy gold accents. ✖

A month or three ago, this was our first taste of ASUS's new 8 Series-chipset generation, but now that we've got the Z87 Sabertooth in the house, too, the Z87-Pro's gaudy gold medallion accessories are much less of a distraction.

Actually that's a bit unfair because this board is actually pretty low key if you look past the dodgy detailing. That's not something we can say about all the new Haswell-compatible boards we viewed at a recent ASUS event. Whether it was pointless RFID kit or bizarre slide-out remote control devices, the air was filled with an air of desperation to come up with something to make each board stand out from the competition. By the end of the show, we'd barely have batted a bag of SATA cables had ASUS wheeled out a motherboard with a mini drinks dispenser as a final flourish. We're not sure why it bothers, because in many ways this rather straightforward mid-ranger and the aforementioned Sabertooth are the most relevant. So anyway, what do you actually get?

Standard Intel Z87-chipset gubbins in a bog-standard ATX form factor to begin with. That's a good thing, because it means full access to all the features of any compatible Intel chip for the new LGA1150 socket – graphics, overclocking, QuickSync, the lot. Then there are six native SATA 6Gbps ports and the same number of USB 3.0 sockets. Ditto the graphics support, which takes in dual x16 slots. For the record, the third physical x16 slot hooks into the PCH chip and therefore only offers four PCIe 2.0 lanes. That's fine for most peripherals, although it's not a goer for graphics. Oh and while we're talking graphics, there's the full complement of video out options: DVI, HDMI and DisplayPort.

Anyway, let's get onto what's specific about the Z87-Pro. For starters there's N-spec Wi-Fi with the Intel Gigabit Ethernet port. You also get a physical power switch, an LED debug display and a button that takes you straight into the BIOS on boot, all of which we're pretty keen on. The chipset cooling is chunky and reassuring to boot.

More importantly, all the overclocking options and tweaks that you've come to expect from an ASUS motherboard are present and accounted for.

There are some new features, too, including the ability to store text notes (such as reminders about optimal settings), along with a modifications log that keeps tabs on the changes you make, allowing you to retrace your steps if something goes awry.

All of which just leaves us with the minor matter of performance. When it comes to the stock clocks, the test results show that the ASUS Z87-Pro is in similar territory to the MSI board opposite, with the exception of gaming, where it's left just a little off the pace. As for overclocking, it's as good as anything else, which is typical for a motherboard from ASUS.

So there's no denying that this is a great package. While the MSI Z87 XPOWER is even better, offering a snazzier feature set for gamers and a more premium feel, it's significantly more expensive.

Jeremy Laird

HIGHLY apc RECOMMENDED

LABS BENCHMARKS

Multi-thread CPU performance

Cinebench 11.5	INDEX score: higher is better
ASUS Z87-PRO	8.05
MSI Z87 XPOWER	8.5

0 2 4 6 8 10

Single-thread CPU performance

Cinebench 11.5	INDEX: higher is better
ASUS Z87-PRO	1.76
MSI Z87 XPOWER	1.72

0 0.5 1 1.5 2 2.5

Video encode performance

X264 4.0	fps: higher is better
ASUS Z87-PRO	45.6
MSI Z87 XPOWER	47.5

0 10 20 30 40 50

Gaming performance

Shogun: Total War 2	fps: higher is better
ASUS Z87-PRO	38.1
MSI Z87 XPOWER	39.5

0 10 20 30 40 50

8/10 MSI Z87 XPOWER

It's got the power, but will you pay for it?

MOTHERBOARD

au.msi.com @

$510 $

Packed with features, excellent performance. ✔

Ridiculously expensive. ✖

Make no mistake, this is a seriously fine motherboard. However, for $510, this thing shouldn't just provide a nice, comfortable home for your Intel chip of choice and extract the maximum in terms of performance. It should probably put up most of your extended family, make the breakfast and have you weeping with gratitude by asking how your day was after you get home from work when nobody else seems to care.

All of which is a roundabout way of posing the following question: can any motherboard really be worth this much money? Actually, that's easy. It's a no. But that really isn't the point at this end of the market. What really matters isn't whether the MSI Z87 XPOWER can justify its apparently preposterous pricing. No, what matters is that it's seriously hot stuff in terms of performance and it's packed with all the features you could possibly imagine.

And so to the specifications. For starters, this is a board that's been designed with one eye on breaking overclocking world records. That means 32 phase power, so-called 'military class' caps and chokes, LED debug, V-check points and a whole bunch of other stuff that if we're really honest, we struggle to care about.

It's all a bit like having a McLaren P1 supercar. You're never going to do 400km/h in it, but it's nice to know you can. If you care about that sort of thing. Which you should, unless you're awfully shallow and materialistic. But it's hard to resist. And let's be honest, if you had the money you'd cruise around in that McLaren and easily spend $510 on a motherboard with features you're likely never, ever going to use.

Anyway, there's plenty more, including the EMI-shielded audio circuit, complete with a snazzy yellow-backlit transparent tracer line on the board so you can actually spot the bit that's been isolated to ensure clean audio output.

Oh yeah, while we're on the subject, there's no touching the XPOWER if you don't like yellow. Yellow's what it's all about. If you do like yellow, great. This thing looks about as sexy as a yellow-themed motherboard can. Meanwhile, there's a PLX chip to enable silly numbers of Nvidia GPUs in parallel, a Killer E2205 network chip for low latency and, well, a bunch more stuff.

As for performance, it's quick – as in very. The XPOWER tops nearly all our benchmarks and is unbeaten for overclocking, as you'd expect. In terms of quick and dirty overclocks, it doesn't actually give you much advantage over cheaper boards. If you're in the habit of pouring liquid nitrogen over your CPU, though, this is your weapon of choice.

For just about everyone else, it's a damn nice board with a fairly ridiculous feature set you'd love to have if it weren't for that niggling $510 price. Indeed, this board's biggest problem is the question of whether you wouldn't be far better off building something based on Intel's LGA2011 platform if hosing money about is how you roll. And the answer to that is that you would be. In the end, that makes the XPOWER's existence a rather tricky one to truly justify.

Jeremy Laird

General performance: Geekbench 2

	Overall score
ASUS FONEPAD	550
GOOGLE NEXUS 7 (2012)	1,417
GOOGLE NEXUS 7 (2013)	2,649
HP SLATE 7	1,083

0 500 1000 1500 2000 3000

Gaming performance: 3DMark 2013

	Ice Storm, overall score
ASUS FONEPAD	2,232
GOOGLE NEXUS 7 (2012)	3,549
GOOGLE NEXUS 7 (2013)	11,782
HP SLATE 7	2,969

0 2000 4000 6000 8000 10000 12000

Gaming performance: GFXBenchmark 2.7

	T-Rex offscreen test, average fps
ASUS FONEPAD	WOULD NOT RUN BENCHMARK
GOOGLE NEXUS 7 (2012)	3.2
GOOGLE NEXUS 7 (2013)	15
HP SLATE 7	3.2

0 3 6 9 12 15

8/10 Google Nexus 7 (2013)

Say hello to your next Nexus.

TABLET

play.google.com/nexus @

$299 (16GB) $

Super fast hardware, low price, lightweight and slim. ✓

Priced higher than the US. ✗

The original Google Nexus 7 has, without doubt, done a great job of providing Android with a figurehead tablet. What's undoubtedly helped is that the period between its launch (late last year) and now has been a relatively quiet one for Android tablet releases. We've seen the occasional new model sneaking out (Sony's Xperia Tablet Z being the only real big-brand flagship), although most new releases have been low-cost Nexus 7 alternatives. And by and large, those newcomers haven't really been able to knock the Nexus off its perch.

In fact, the only really big complaint you could level at the original Nexus 7 is that for long-time owners, it's started to show its age. Many early buyers have legitimately complained of general slowness and creaky interface speed – something that's a result of degrading storage performance because Android hasn't properly supported TRIM. The latest release of Android, 4.3, has finally addressed this, so 2012-model Nexus 7s that have the update installed should start to feel young again. (We've also addressed other ways you can fix general slowness on Android devices on page 90.)

In broader terms, however, ARM hardware has been moving at an almost scary rate and 10-odd months after release, that first Nexus 7's core components are looking pretty far from modern. Newer Android phones can manage two, three or even four times the performance, depending on the test. If anything, this new Nexus is perhaps a little overdue then; however, to be fair, using not-quite-bleeding-edge hardware is likely a necessary concession to keep the price low.

Once again made by ASUS, this updated model does bear a lot of similarities to its predecessor, with a similar device footprint, button placement and that eponymous 7-inch screen. Those aside, it's also fairly radically different in many other areas. The IPS display has been bumped up from 1,280 x 800 pixels to 1,920 x 1,200, more than doubling the pixel count and providing contrast and colours that are a wee bit better, so it doesn't look quite so flat and washed out as before. It's not perfect – squint hard and you'll be able to see very slight horizontal bands (in portrait mode) caused by a large open space between pixel rows. Yes, we'll admit that we're nitpicking a bit here – the screen is still fantastic given the price.

Inside there's also a new variant of the Snapdragon 600 'system on a chip', with a quad-core CPU running at 1.5GHz and an Adreno 320 doing graphics duties. Those are basically on par with the chips used in the blazing-fast Galaxy S4 and HTC One. And that makes for very responsive performance no matter what you're doing – apps and web pages launch and load in an instant, there's no waiting for widgets to refresh and every game we tried was butter smooth.

It also feels great in the hand. The smooth-touch matte plastic back isn't quite as grippy as its predecessor's textured finish, but its feathery weight and thin profile more than compensate. And the new Nexus 7 genuinely has the best speakers we've heard in a 7-inch tablet.

In short, this is a successor that's been improved in almost all the right ways – it's thinner, lighter, faster and more attractively designed.

We are a bit disappointed that it's not lower-priced locally; in the US, this 16GB model goes for $229.99, so there's certainly a layer of the Australia tax being added on top here. Still, even at $300, this is an incredibly powerful and competitive mini tablet. Take a look at the benchmarks results above and you'll instantly see just how big a jump this is over most of the other 7-inch Android tablets kicking around in today's market.

Whether any other vendors will be able to best this new Nexus is obviously something we'll have to wait to find out. As of right now, though, you won't find a more future-proof mini tablet.

Dan Gardiner

APC's review unit was provided courtesy of Mwave.com.au.

Surf with Confidence
Fast, Safe, Reliable, NBN Ready

Vigor2860 series - Business Class Firewall Router
Triple-WAN, VDSL2, ADSL2+, 3/4G mobile, Gigabit Switch, 32 VPN tunnels

NBN READY

TAIWAN EXCELLENCE 2013

- Triple WAN router with Fail-Over and Load Balance for reliable Internet access and flexibility; VDSL2/ADSL2+, 3/4G mobile USB, Gigabit Ethernet WAN ports for diversified Internet access.
- 6 x Gigabit LAN ports for high speed network connectivity.
- Multiple VLAN (802.11Q), Port or IP based, for easily separating departmental or workgroup networks.
- 50k NAT sessions and IPv6 for NBN readiness.
- 2 x USB ports for 3/4G mobile WAN, FTP and printer server.
- 32 x VPN tunnels with hardware accelerator, comprehensive protocols for easy interoffice communication.
- 10 x SSL VPNs, 16 x OpenVPN and VPN Trunk (Load Balance / Fail-Over).
- Object based SPI Firewall with DoS/DDoS defence, Web Content Filter, Content Security Management, etc. for maximum network security.
- TR-069 (VigorACS SI) remote management system, Smart Monitor, QoS and management tools for simplifying administrator's tasks.

	Vigor2860	Vigor2860n	Vigor2860Vn
Wireless AP		◉	◉
VoIP			◉

Vigor2760 series - SOHO Class Firewall Router
VDSL2, ADSL2+, 3/4G mobile, Gigabit Switch, 2 VPN tunnels

TAIWAN EXCELLENCE 2012

- Built-in VDSL2/ADSL2+ modem and 3/4G USB WAN port for reliable Internet access and flexibility.
- 4 x Gigabit LAN ports for high speed network connectivity.
- Port based VLAN for easily separating workgroup networks.
- 30k NAT sessions and IPv6 for next generation broadband readiness.
- 2 x USB ports for 3/4G mobile WAN, FTP and printer server.
- 2 x VPN tunnels with hardware accelerator, comprehensive protocols for easy home/office communication.
- Object based SPI Firewall with DoS/DDoS defence, Web Content Filter, Content Security Management, etc. for maximum network security.
- QoS (Layer 2&3, 802.1P, TOS/DCSP) for prioritizing video, voice, online game and data traffic.
- TR-069 (VigorACS SI) remote management system and management tools for simplifying administrator's tasks.

	Vigor2760	Vigor2760n	Vigor2760Vn
Wireless AP		◉	◉
VoIP			◉

i-LAN TECHNOLOGY

i-LAN Technology Pty Ltd trading as DrayTek Australia

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6/10 ASUS Fonepad

Too slow to be a contender.

TABLET

www.asus.com/au @

$300 $

Solid chassis, 3G enabled, microSD slot. ✔

Poor performance, even by last year's standards. ✖

ASUS has built up a reputation for experimentation over the last few years, launching a host of unusual devices such as the PadFone – a unit which pairs an Android smartphone that docks into the back of (and powers) a 10-inch tablet. Despite the similarity in the names, this Fonepad takes a completely different tack to the PadFone: it's a 7-inch tablet that includes the ability to make phone calls, thanks to the addition of a 3G radio (HDPA+ 21Mbps) and a micro-SIM slot in the top.

The main attraction here is the low price – the 8GB version goes for around $300. By comparison, a 4G-equipped iPad Mini starts at $509 and the new Nexus 7 with 4G is $439.

If you're looking for an always-connected mini tablet, then you've basically got two frugally-priced choices: the Fonepad or Google's older 2012 Nexus 7 ($349). Indeed, the Fonepad does look a lot like that older Nexus 7: both have 7-inch, 1,280 x 800-pixel screens and are very similar physically. That's perhaps not surprising, considering that both tablets are made by ASUS. The Fonepad does arguably do better than the Nexus in a couple of spots, however, with a tougher-feeling metal chassis and a microSD slot allowing for storage expansion. And as usual, ASUS hasn't messed with the Android interface much – the company's custom skin is very close to the stock design, so it's straightforward to use.

On the downside, in use the Fonepad often doesn't feel too fast or smooth. That may be down to the dual-core Intel Atom Z2420 CPU (running at 1.2GHz) and 1GB of RAM. While those specs don't sound too bad on paper – these x86 parts can match their more common ARM competitors when it comes to things like battery life (managing to stream ABC News 24 for 9:22hr) – in real-world tasks the Fonepad just wasn't as snappy as our 2012 Nexus 7, something that was also borne out in benchmark results, where it was often over 30% slower. Considering that the Nexus is coming up to being a year old and has effectively been superseded, that's not encouraging.

If you're after a low-priced 3G tablet, we'd grab one of those older Nexus 7s before they all disappear.

Dan Gardiner

6/10 HP Slate 7

You get what you pay for.

TABLET

www.hp.com.au @

$195 $

Solid and robust feel, microSD slot. ✔

Low-res screen, comparatively heavy. ✖

Coming in at close to half the price of the cheapest iPad Mini, HP's 7-inch, Android-powered Slate 7 tablet does seem a little too good to be true. Can you really get a big-brand mini tablet at this kind of price? And if so, what are the compromises?

HP's uber-budget tablet does some things quite well. While the chassis is mostly plastic, the Slate 7 still has a solid and reassuring build quality, and the brighter colour choices (our test model came in bright red) manage to stand out from the almost universally white, grey or black colour schemes f other Android tablets. There's even a microSD slot to expand the media and file storage – a good thing considering there's only 8GB on board (with just under 6GB user-accessible).

While we wouldn't describe it as quick, the Slate 7 is at least fast enough to handle the basics of web surfing, email and watching movies (well, mostly... the ABC News 24 app staunchly refused to sync audio and video in our tests). Inside there's an off-brand dual-core 1.6GHz ARM Cortex-A9 CPU with 1GB of RAM and a Mali 400 graphics chip. The latter puts it roughly on par with the original Nexus 7 for gaming speed.

The Beats Audio speakers are likewise passable, though we wouldn't want to use them for prolonged movie-watching or gaming. HP has also mercifully left Android all but untouched, not bothering to customise it with superfluous (and oft performance-draining) visuals skins, as many others still do.

So what are you sacrificing? For one, the screen is an odd one, using a 16:9 aspect ratio (most Android tablets are 16:10) that makes it a little too narrow for comfortable web surfing, especially in portrait mode. The screen is also comparatively low-res at 1,024 x 600 pixels, which can render some of Android's smaller fonts pixelated and oddly gappy. There's also no auto brightness setting for the display (there's no light sensor to power it) so if you ever need to change brightness, you'll need to dig down into the main 'Settings' menu.

At 364g it also feels a tad weighty for its size, especially compared to the new Nexus 7's 290g.

Ultimately, if you can't spend more than $200 for a tablet, those shortcomings can be put up with. But when you can get a 32GB, 2012-model Nexus 7 for around $240 online, we think it's worth spending that little bit more so you don't have to.

Dan Gardiner

ASRock Z87 Extreme3

8/10

Cheap but powerful.

MOTHERBOARD

www.asrock.com @

$169 $

Good value, great performance, overclocking potential. ✓

Some features missing. ✖

Cheap and slightly shonky, yet quirky and intriguing boards. That used to be ASRock's place in the world. These days, however, the manufacturer has gone a bit mainstream.

On the upside, that means a range of more straightforward models, including some high-end components. That said, old affinities die hard and we're a little bit more comfortable with the prospect of this bargain-basement board with an ASRock badge than some of its closest competitors; there are some rather disappointing competitors at this price point from 'bigger' brands like Gigabyte and MSI.

Physically, you do get what you pay for here. The Extreme3 has a very thin PCB, with a sludgy colour and flimsy feel that gives the unsavoury impression of being mashed up from recycled games cartridges from 'the 80s or pressed peanut sweepings from the factory floor. OK, the latter's a bit of an exaggeration, but you get the idea. Think cheap. Think commodity electronics banged out in massive numbers in dingy factories.

Anyway, at this end of the market, you'd expect to miss out on a few frills and that's certainly the case here. LED debug display, onboard power and reset switches, fancy dual-BIOS toggles, V-check points. No, no, no and no. Which, for the most part, is fine by us. Kit like that is nice to have, but ultimately it isn't critical for extracting the best performance out of your card.

That said, there are a few so-called convenience features missing from the spec that might niggle some, depending on your specific preferences. There's no DisplayPort for the integrated graphics output, for instance, and the back panel is limited to just four USB 3.0 ports. That's pretty mean, although shaving off pennies in production costs is what it's all about at this price.

However, it's not all bad news. One feature you might not expect to find is support for Nvidia's SLI multi-GPU tech. You don't get it with the similarly-priced Gigabyte GA-Z87-D3HP, but you do with this ASRock. Again, that sounds like a proposition that's frill-free, but presents no barriers to max performance. Is that really the case?

Kind of. In our stock-clocked benchmarks the ASRock doesn't exactly blow away all comers, but it knocks out in excess of eight points in Cinebench and beats a number of Z87 boards in x264 HD video encoding. If there's a snag, it's gaming performance, but even here we're only talking about a single frame per second behind most other boards. In other words, you won't know the difference.

As for overclocking, it's good news. The auto-overclocking feature is a bit of a busted flush because it boots at very high speeds and downclocks under load, but force the multiplier settings and your reward will be an impressive overclock.

For the record, we squeezed a solid 4.7GHz and over 10 points in Cinebench out of a Core i7-4770K. That annihilates most equivalently-priced competitors. It's as good as anything else on test this month, including the monster $510 MSI Z87 XPower. Oh, and it's faster than the board that's actually its closest rival, MSI's Z87-GD43 (see APC August, page 52).

Jeremy Laird

8/10 Logitech G710+

Welcome to the mechanical club.

KEYBOARD

www.logitech.com @

$180 $

Adjustable key backlighting, macroable G keys. ✓

Brown key switches won't be to everyone's tastes, pricey. ✗

Logitech has found itself something of a latecomer to the mechanical gaming keyboard party – an unusual position for the proactive peripheral maker to find itself in. So has Logitech's first foray into the clackety land of mechanical switches been worth the wait?

If you're unfamiliar with mechanical keyboards, for the faithful they're thought to confer a range of benefits over their more common membrane-switch counterparts – mechanical is technically an older keyboard tech, with a discrete mechanism used to fire each key. In theory, that can provide better stability, reliability and speed, but the thing most people will notice is the feel... and perhaps noise.

There are a handful of different mechanical switch types (referenced by the colour of the plastic they're moulded from), which actually do feel different under the finger. Logitech has gone with the unusual choice of Brown Cherry MX switches with the G710+, which differ from the more common Black and Red types in that they have a definite 'hump' when it comes to activation, so you can actually feel the exact spot in a key's up/down motion where it fires. That theoretically allows you to 'ride' keys and use smaller and therefore quicker finger movements, though that's admittedly something only a pro gamer probably needs.

In use, the G710+ is pleasing – it's a little quieter than the worst of the mechanical keyboards, but if you're after something very discreet, this isn't it; use this one in an office and your nearby workmates will be able to hear every keystroke. They keys do have a little more wiggle at the top than we'd like, though it's not so much that you're in danger of slipping off.

In terms of advanced features, there are six of Logitech's G-keys on the left side (which you can bind macros to using the company's Gaming Software tray app), plus a nicely large volume dial on the top-right and the ability to adjust the backlight strength under the keys (the W, A, S and D keys have their own discrete brightness control). That lighting control isn't as impressive as what's on the K95 below, but it does let you easily find the main FPS keys in the dark.

In all, this is a solid first effort from Logitech. As with the K95, it's a little more expensive than we'd like – especially considering its mostly plastic construction – but if you're a fan of Logitech's kit and software tools then this one will be a good addition to you gaming setup.

Dan Gardiner

8/10 Corsair Vengeance K95

Remember: lift with the legs.

KEYBOARD

www.corsair.com @

$189 $

Full-sized keyboard, great key spacing, Cherry Red mechanical switches, great lighting options. ✓

Build quality inconsistencies; we question the choice of switch. ✗

The first thing you'll notice after tearing off the plastic wrap is the K95's unmistakable lactic build-up and shaking arms from lifting this behemoth onto your desk. OK, it's not quite that bad, but this is a big unit. Coming in at a whopping 50cm x 21.5cm, and heavy in a Colonel Mustard-in-the-kitchen sense (even without its detachable wrist rest screwed into place), its black anodised aluminium chassis is a sight to behold. Oddly however, the base plate of the macro section is made from plastic and not the same aluminium material as the rest. It doesn't quite sit flush and is a real let-down for what is otherwise a super-slick and minimal design.

Rounding out the keyboard's modest features list are 18 fully macroable G-keys (via the free downloadable engine), the now industry-standard braided cabling, USB 2.0 pass-through, full multimedia controls, windows lock-out and full-key rollover. However, the standout feature has to be the customisable lighting options, which allow you to control (and save) key lighting on an individual key level. It's great if you like genre-hopping or even if you like the convenience of at-a-glance indicators for more complex non-gaming applications.

Unlike the previous-iteration K boards, which are only mechanical switched in the most frequently used gaming keys, it's a complete Cherry Red fit-out on the K95. While we understand Red switches are considered the 'gaming' switch – featuring a super-responsive low-pressure operating force of 45g and 2mm travel – but for our money they're a little redundant on a board geared primarily for a more methodical, non-twitch, macroed G-key world. We would have preferred to see it outfitted with Brown or Black keys, which offer a little more resistance.

Overall, the K95 is an extremely capable and powerful gaming keyboard, but it does come at a premium price point. But it's potentially worth it, just for that sweet lighting.

Troy Coleman

9/10 Dell UltraSharp U2713H

What a difference one letter makes.

MONITOR

www.dell.com.au @

$949 $

A gorgeous, factory-configured pro screen that improves on its predecessor in every area. ✓

You'll pay for it. ✗

Stop. Before you move on, thinking that you've already read about this particular monitor in *APC*, take a quick look at that model name. It's incredibly easy to confuse this professional-pitched Dell screen with the very similar yet cheaper U2713HM – after all, this newer one makes the odd choice of knocking *off* a letter from the end of the name.

That small detail hides some rather significant differences, however. While both screens are theoretically upgrades to the U2711 (released in 2010), being IPS displays with 2,560 x 1,440-pixel resolutions, the U2713HM actually compromises on a variety of high-end features in order to hit a more wallet-friendly price point. This newer U2713H is actually the true successor to the U2711 and it restores all the features that were missing from the HM, and then some.

Most other 27-inch IPS monitors are going for $800 or under, so what does an extra $150 get you here? Dell primarily pitches the H as being superior to the HM because it's factory-calibrated for colour accuracy. What that means specifically is that it has selectable colour presets to match the Adobe RGB and sRGB standards at 99% and 100% accuracy, respectively. For anyone doing colour-critical design or video work, that should mean you can just plonk one of these on your desk and start using it immediately without having to break out specialised colour calibration hardware.

The differences between the H and HM are actually much more than that, though. The H's underlying hardware is actually far more premium, restoring (nay, beating) the older U2711's extremely wide colour gamut through its use of an 8-bit panel, as opposed to the 6-bit panels that are used almost everywhere else, including in the HM.

Those specs differences aren't just something you'll see on paper either. We compared the U2713H directly with the older U2711 and there was honestly no contest between the two. Side by side, the differences in colour, contrast, brightness and image clarity were much bigger than we expected. Perhaps the single biggest reason for that is that the U2711 was saddled with a widely loathed antiglare coating, which notoriously produces a subtle sparkle effect – something that's especially noticeable on lighter backgrounds. The U2713H switches to a newer and far more subtle antiglare coating that's effectively invisible, leading to a much cleaner and more vibrant overall image. It can border on fluorescent at times, but manages to ride just on the right side of that line most of the time.

What also helps the appeal is that, even though it's considerably brighter than its forebear, the U2713H actually pull significantly less power – 55W compared to the U2711's 100W when sitting idle at the Windows desktop.

And even though this unit has a merely average response time (6ms grey-to-grey), ghosting was minimal to non-existent in our FPS testing.

Taken in isolation, all of those feature bumps and improvements might not be enough to consider this as an upgrade if you already own a U2711 or U2713HM. But considered all together, they really do start to stack up. This may be one of the more expensive 27-inch monitors money can buy, but if you genuinely need those high-end colour features, this really is the ultimate pro screen and a truly worthy successor to the U2711.

Dan Gardiner

LABS ZALMAN LQ315 ULTIMATE BENCHMARKS

Stock-clocked loaded performance

Core i7-3770K at 3.5GHz	Degrees Celsius: lower is better
ZALMAN LQ315 ULTIMATE	59
THERMALTAKE WATER 2.0 PERFORMER	54
COOLER MASTER EISBERG PRESTIGE 120L	66

0 15 30 45 60 75

Peak to idle performance

Core i7-3770K at 3.5GHz	Seconds: faster is better
ZALMAN LQ315 ULTIMATE	168
THERMALTAKE WATER 2.0 PERFORMER	154
COOLER MASTER EISBERG PRESTIGE 120L	166

0 40 80 120 160 200

Overclocked loaded performance

Core i7-3770K at 4.5GHz	Degrees Celsius: lower is better
ZALMAN LQ315 ULTIMATE	85
THERMALTAKE WATER 2.0 PERFORMER	70
COOLER MASTER EISBERG PRESTIGE 120L	94

0 20 40 60 80 100

8/10

Zalman LQ315 Ultimate

Can the thicker radiator deliver the performance to justify its price?

CPU COOLER

www.zalman.com @

$90 $

Fairly small, easy to install, whisper quiet. ✓

Isn't quite as good as its cheaper sibling. ✗

Zalman was one of the first names when it came to chucking liquid at your CPU. Mostly that was down to its monolithic Reserator, a tower of water cooling goodness that became a beacon of liquid chilling. Then it all got easy with smaller, closed-loop coolers that were a doddle to install and we stopped hearing so much from Zalman in the consumer space.

However, with the impressive, budget-oriented LQ310 we saw a couple months back, Zalman is now back on the map. Its LQ Ultimate range of closed-loop liquid CPU coolers comprises just three models, each one defined by its Qmax (maximum cooling level). This LQ315 sits in between the LQ310's 300W Qmax and the LQ320's 350W, with a middling 330W Qmax. Each iteration has a slightly thicker 120mm radiator for healthier cooling performance. This LQ315 is 10mm taller than the LQ310, so what extra performance does it offer?

The water block measures just 32mm high and 65mm in diameter, and weighs a mere 195g. So long as there's space for the 120mm radiator, this cooler will fit small form factor cases. The unit comes with a single 120mm fan in the box, but a second one can be mounted if need be. The block is made from pure copper and features micro fins to help transfer the heat away from the CPU. The system uses a glycol-based liquid coolant with added corrosion inhibitor to protect any metal parts and ensure the minimum of maintenance issues.

We've tested a few mainstream liquid coolers lately and all of them have one thing in common: ease of installation. Thanks to a well-illustrated manual, the LQ315 Ultimate doesn't buck the trend. It took us around 20 minutes to install – that's as quick as some air-cooled chillers we've wrestled with lately.

The LQ315 Ultimate is whisper quiet in operation most of the time, too, thanks to the 120mm PWR fan of Zalman's own design, which spins between a quoted 900 and 2,000rpm. Testing the CPU under 100% load at its standard 3.5GHz clock speed produced fan noise that was hardly noticeable. Inevitably, it was a slightly different story with the CPU overclocked and running at 100%, although even then it wasn't overly loud.

The single 120mm fan manages to keep the Core i7-3770K within reasonable temperatures and a good distance from the TJ Max of the CPU at standard speeds. When it came to keeping the overclocked CPU cool, the LQ315 did an admirable job, but started to struggle when the CPU was pushed at 100% for long periods. However, it did just manage to keep the temperature in the mid-80s, making the distance to the TJ Max of the i7 a little too close for comfort for us; even so, it's hardly failing at its job.

The $80 LQ310 offers an excellent combination of price and performance. The LQ315, while very capable, needs to offer much healthier chip-chilling chops to justify the extra expense. The 120mm Thermaltake competition here has the edge in both price and performance .

Simon Crisp

7/10 TomTom GO 600

A big-screen GPS that covers the basics well.

GPS

www.tomtom.com @

$299 $

Clean interface, fast ✓ ration/recalibration, fetime maps service.

o big, red light/speed ✗ mera warnings vastly unreliable.

We get why TomTom thinks a 6-inch touchscreen GPS is a great idea – it's easier to view routes and pending instructions without having to squint and pinch to zoom too much – but we just don't think the added screen real estate from more standard 5-inch models is worth the impracticality. In my tiny bubble of a Toyota Yaris, no matter where I positioned the GPS on the windscreen, it heavily obscured my view at particular angles. In the generic bottom-middle position of the windscreen, it was impossible to see if cars to my left were indicating, for example. Not safe.

Another gripe we had on our test drive was its ability – or should we say inability? – to detect speed, safety and red light cameras. This proved to work sporadically; on its best run it detected six cameras, but just when we thought it had gotten the hang of things, it failed to detect the last red light camera on our route home, not to mention most of the speed cameras on our route towards Sydney's CBD. It was also odd that the GPS's speedometer was always 3km/h slower than the car's, although at least it's consistent.

What the GO 600 does do well is provide an efficient and intuitive user experience. TomTom emphasises the 'Tap & Go' functionality of its new GO range – simply tap on the map and you're on your way. The company has in a way ditched the 'Home' menu, enabling you to look up places straight from the map to save time. Once you input the first three letters of an address or point of interest, the device starts to list possible locations for quicker searches, too.

Ultimately, a GPS should get you from point A to point B. The GO 600 does this very well, as it calculates routes quickly and should you go off course, it'll recalibrate in mere seconds. Its advanced lane guidance feature also clearly shows which lane to take at junctions, which is handy. However, if you perhaps drive a small vehicle or rely on camera warnings (naughty!), there are probably better options to be had elsewhere.

Goldie Hong

7/10 Huawei Ascend P2

Is this the fastest 4G phone in Australia?

SMARTPHONE

huawei.com/au @

$504 outright or on $60/month Telstra contract $

CAT4 has excellent speed potential. ✓

ixed storage, average performance, only Android 4.1. ✗

Huawei's a name you usually associate with budget line phones (if you register the company at all), with most of its consumer products making it to Australia only to be rebadged as Optus or increasingly Telstra products. The Ascend P2 is a Telstra exclusive, but it's under Huawei's own branding, bringing together a bunch of mid-range specifications: a 4.7-inch 720p-capable IPS LCD screen sitting above a 1.5GHz quad-core ARM processor, Android 4.1 and 32GB of storage. There's no microSD slot, so you can't add any more storage to it, and Huawei's own Android skin, the Emotion UI, is nothing particularly remarkable. Geekbench reported back an overall score of 1,680, which is hardly Earth-shattering. The design is equally middling – a slab of glass and plastic that doesn't feel particularly inspired.

So why is it remarkable at all? It's because Huawei's thrown one bit of interesting technology into the Ascend P2. It's the first phone in Australia to offer CAT4 LTE, which means it's theoretically capable of download speeds up to 150Mbps, where CAT3 LTE devices – basically any other LTE phone you'd care to name – peaks at a theoretical 100Mbps. That CAT4 only makes sense if you can find a CAT4 cell, that is. Telstra's currently only running its LTE network in CAT4 mode in selected areas of Perth, Adelaide and Brisbane; for testing purposes we stuck a Vodafone SIM into the P6, where we managed **www.speedtest.net** results that peaked at 89.5Mbps. That's the fastest rate we've ever seen out of a smartphone.

The real issue with the Ascend P2 is that while it's the first and undeniably currently the fastest, it's likely that we'll see more CAT4 phones in the near future, as well as more network coverage to actually feed them data. If you must have the fastest possible mobile data it's the phone to buy right now, but outside its download muscle, there's nothing really exceptional about this phone at all.

Alex Kidman

CREATE YOUR OWN CLOUD

11 NAS BOXES LAB TESTED

WITH MOST NAS BOXES NOW INCLUDING AT LEAST BASIC WEB-BASED ACCESS TO THEIR CONTENTS, IT'S NEVER BEEN EASIER TO ROLL YOUR OWN WEB-CONNECTED STORAGE DEVICE.

Network-attached storage boxes have never been the types of products to spawn legions of fanboys or that appear on the cover of glossy magazines (well, *APC*'s cover is kind of glossy), but for many households and businesses, that doesn't make the NAS any less important.

Off-the-shelf NAS boxes have changed quite drastically over the last few years, going from simple dumb storage to much more powerful appliances, complete with their own ranges of apps and plug-ins. More recently, they've also started to include web-based access to their contents, with many brands even going so far as to provide dedicated mobile apps for Android and iOS.

While cloud storage services are now fairly ubiquitous, with the likes of Dropbox and SkyDrive household names (though Microsoft is being forced to change the latter after losing a court battle against UK TV broadcaster BSkyB), we'd argue that there are lots of compelling reasons to create and host your own one. Here are five to get started.

01 PRIVACY

The recent revelations of the US National Security Agency's widespread snooping via programs like PRISM has put the spotlight on just how private our online activities really are. To be fair, big tech companies like Microsoft, Google, Dropbox and others do vary in how willingly they'll comply with requests for your cloud data – some are more resistant to government pressure than others. Host it yourself, however, and you don't have to worry about that aspect at all. You can decide exactly who can access your data.

02 COST

Many cloud services are free if you only want the basics, although if you want to go beyond that you'll usually have to sign up for a paid subscription. Those ongoing costs can add up quickly, especially if you're using multiple pro-level services. Building your own cloud-connected NAS or small server means you'll only pay a one-off fee and you might even be able to do it for free, if you find you can recycle an old PC and hard drives.

03 UPGRADABILITY

If you do find your storage – and other needs – aren't being met by your current setup, it's not too tricky to add bigger hard drives or (as we've covered under 'Flexibility'), enhance the features on offer by adding dedicated applications. Many readymade NAS devices now receive regular firmware updates that bring with them new capabilities – and they won't cost you a cent.

04 FLEXIBILITY

A cloud NAS box doesn't have to be just about storage either. If you choose to build one from scratch (see page 44), your options for expansion are really wide open. You can add features such as media transcoding, web-based document collaboration (**etherpad.org**), rsync for automated PC backups, or BitTorrent Sync to get Dropbox-like file syncing across all your different devices (even Android and iOS).

05 SPACE

The other great advantage of a DIY cloud box is that it can have as much storage as you need (or at least can afford). Dropbox's US$99 yearly fee nets you 100GB of online storage, although for around the same price you can buy a 2TB hard drive. If you want to keep a huge media collection at your fingertips, this is the way to do it.

CLOUD-CONNECTED NAS BOXES

Network-attached storage gets smarter every year and now bundles in a huge array of features and functions, including cloud sharing. Lindsay Handmer tests 11 of the latest.

NAS devices have gotten progressively faster and cheaper in recent years, although cloud access is the latest improvement to become mainstream. The cloud connectivity these offer does vary. In its simplest form, you can remotely log in and manage your NAS or upload and download files via a web browser. Many manufacturers have also bundled the same access into their dedicated smartphone apps in an effort (with varied degress of success) to improve the configuration experience you'll get over using a mobile browser.

The next level of cloud access essentially turns your NAS into your own personal version of Dropbox, able to share files out to PC, Mac, Linux and mobile devices via your home (or office) internet connection. The best cloud compatibility lets you integrate your existing online storage into your NAS for the best of both worlds.

We noted that none of the NAS devices we tested had apps available for smartphone platforms other than Android and iOS. They all provided access via a web browser; however, apps did generally give a better experience on mobile devices. That said, many of the apps were still buggy or lacked a full feature set.

Aside from cloud connectivity, there are a number of features of NAS devices to consider. If you don't want to do any fiddly setup, make sure you buy a NAS that has the hard drives preinstalled. If you want to use existing drives from your old laptop or PC, check whether the NAS can handle both 2.5-inch and 3.5-inch drives.

Power use is also important to consider, as a NAS typically runs 24/7. All the NAS devices we tested power down when not in use and use very small amounts of power, but if you're regularly accessing files or using the NAS to download from the net, the electricity use does add up. Over a year, a high-powered NAS could easily use $100 or more of power, while a small low-power unit might be just $25.

HOW WE TESTED

Where applicable, all the NAS devices were tested using preinstalled drives; if none were included, then dual 2TB Western Digital Enterprise storage hard drives were used in the NAS devices' default RAID configurations. We tested each device's transfer speeds using LAN Speed Test, in addition to testing real-world read and write speeds with a single 5GB ISO file, as well as a 5GB directory that consisted of a variety of files, programs and media, representing a typical back up job.

Power was measured at the wall, using a commercial power meter.

We tested the Android apps with a Samsung Galaxy S4, while iOS apps were tested using an Apple iPad.

SINGLE-BAY NAS DEVICES

6/10

$249

- SAMSUNG SMART TV APP
- DNLA MEDIA STREAMING
- MAC SUPPORT

Seagate Central

Ready to go right out of the box.

- www.seagate.com
- ✓ Small, easy to use, quiet.
- ✗ Poor apps, limited storage options, single USB input.

A single-bay NAS might not sound like your typical offering, but the Seagate Central is aimed at those who just want a simple home network storage setup. It's designed to be plugged directly into your router and comes in 2TB, 3TB and 4TB flavours. The Central is also super-sleek and will look at home next to any modem or router. The Central uses a 700MHz ARM CPU and 256MB of RAM. It doesn't use a fan, though a small amount of drive noise does escape during use and it drew 11W of power from the wall.

You can access the Central from any computer or mobile device via a web browser to manage, upload or download files, as well as securely share files with family and friends via email invitation. For a simpler mobile experience, there are also mobile apps for Android and iOS. While theoretically good, we found both apps to be slow and buggy, and we had numerous issues getting media to stream. The iOS app was the worse one of the two, but both were ultimately disappointing considering the Central's strong mobile focus.

The Central supports DLNA media streaming and can wirelessly stream movies, music and photos to any compatible device – from media players to game consoles. It also supports Apple AirPlay, which means you can integrate it with your iPad and Apple TV. There's also a Samsung Smart TV app that makes accessing your media on your TV very easy.

You can set the Central to automatically back up multiple PCs and it supports Apple's Time Machine backup. For those who love their social networks, the Central can also back up your Facebook accounts.

Shop around online, as the 2TB versions can be found for a touch over $200, while the 3TB will set you back $260 and the 4TB $330.

TWO-BAY NAS DEVICES

HIGHLY apc RECOMMENDED

- BITTORRENT DOWNLOADING
- PRINT & FTP SERVER
- DLNA MEDIA STREAMING

8/10

$149

D-Link ShareCenter DNS-320L

Basic, but oh so affordable.

- www.dlink.com.au
- ✓ Cheap, fast, great cloud options.
- ✗ Few ports, USB 2.0 only, low spec.

Servicing the lower-budget basic end of the NAS spectrum, D-Link's ShareCenter does without many of the bells and whistles of its more expensive brethren. It's a two-bay NAS, but the drives need a handle screwed on before they're slotted into the unit and it only supports 3.5-inch drives. On the plus side, it's nice and open, and uses passive cooling, which reduces noise, plus it has RAID 0, 1 and JBOD. The connectivity options are limited to a single Ethernet connection and a USB 2.0 port – there's no USB 3.0.

Our unit came with a 1TB Seagate hard drive and setup was as easy as inserting the included CD and running through some basic options.

The DNS-320L uses a Marvell 88F6702 processor that chugs along at 1GHz, backed up by 256MB of RAM. Despite the low spec, in our synthetic benchmarks, the ShareCenter was only a little slower than more powerful NAS devices. That said, considering its budget nature it offers excellent bang for buck. It also performed very well in the large file tests, as well as our document backups – it managed to just best its high-spec competitors.

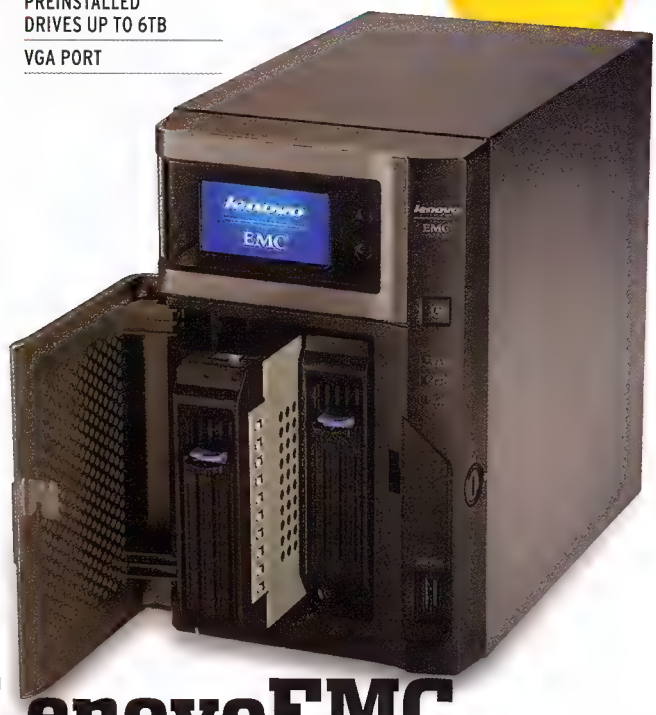
The DNS-320L includes DLNA media streaming as well as BitTorrent downloading and it can be used as a print and FTP server. Cloud connectivity is actually pretty solid, with Amazon S3 cloud backup, as well as web access to the NAS from any computer. The MyDlink Cloud app lets you access your NAS via Android or iOS – while it's basic, it does get the job done. With a single drive installed, the DNS-320L sips just 9W of power when idle.

With no drive the ShareCenter can be found for under $100 online, although you can expect that to more than double if you want it with a 2TB drive preinstalled.

6/10

$1,029

- IP VIDEO SURVEILLANCE
- PREINSTALLED DRIVES UP TO 6TB
- VGA PORT



LenovoEMC px2-300d

With the powers of Iomega and Lenovo combined...

@ www.iomega.com.au

✔ Efficient, easy setup, inbuilt virus scanner.

✖ Buggy apps, no DLNA, pricey.

The px2-300d has an older yet still powerful dual-core 1.8GHz Atom CPU with 2GB of RAM. It can handle dual 3.5-inch drives running in RAID 0, 1 or JBOD. It's got a single USB 3.0 port, two USB 2.0 ports as well as dual Gigabit Ethernet ports. It's also got a VGA port if you want to connect a local display. Unlike a lot of NAS products, it has a basic LCD that gives you information about the NAS, such as available storage space and error messages.

Our px2-300d came with dual 1TB drives preinstalled, so setup was just a matter of turning it on, although you can also get up to 6TB of storage included or a completely diskless option. Cloud connectivity is provided via web login, as well as LenovoEMC's Personal Cloud service. This lets you access your files on Windows, Mac or Linux PCs and works much like Dropbox, just with the files stored on your NAS and accessible via the internet. You can also link with other cloud services, such as Amazon S3 or MozyPro. The Iomega Link app lets you access your NAS via your smartphone; however, we found the Android version very buggy and hard to use. The iOS app was slightly better, but it lacked the in-depth functionality to make it truly useful.

This LenovoEMC unit is aimed at the business market and as such, it may miss out at grabbing the attention of power home users, as there's no DLNA media streaming or torrent downloading. On the plus side, it can handle 16 IP cameras for video surveillance. It's also got an inbuilt virus scanner to keep you safe from any rogue files. Chugging away backing up our files, the px2-300d drew 29W – that's still fairly efficient, considering the specs.

With those two 1TB drives preinstalled, the LenovoEMC is rather expensive at $1,029, however.

6/10

$509

- HDMI OUTPUT
- INTEL ATOM CPU
- DUAL GIGABIT LAN PORTS

Netgear ReadyNAS 312

Power in a petite package.

@ www.netgear.com.au

✔ Fast, solid cloud options, good connectivity.

✖ Pricey, glitchy setup, noisy.

The ReadyNAS came with drives, although setting it up via the included CD was a little painful. It uses Java and we had multiple issues getting it to install. Once we were past that initial hurdle, the rest of the process was relatively easy and gave excellent control, as well as advanced details such as drive temperatures and fan speeds.

The ReadyNAS has dual bays which can house both 3.5-inch and 2.5-inch drives for a total size of 8TB. It uses a dual-core Intel Atom CPU running at 2.1GHz and has 2GB of RAM.

The ReadyNAS is packed with connectivity options – round the back you get dual Gigabit LAN ports, eSATA and two USB 3.0 ports. You also get HDMI, letting you plug in a monitor. On the front is a single USB 2.0 port with a 'Backup' button that automatically copies data from a drive.

Despite our minor setup issues, the ReadyNAS performed very well and was considerably faster than its competitors with lesser CPUs. In use it's fairly loud, from both drive noise and fan hum.

The 312 has a number of cloud connectivity features. For a start, it has a remote app for both iOS and Android. Both give you basic FTP-style access to your files, though the Apple version is the slightly more polished of the two. ReadyNAS is a Dropbox-style system that lets you easily sync your files between a PC and Mac, though sadly, it doesn't support mobile devices. ReadyCLOUD makes accessing and managing your NAS via the internet easy – just log in via the web site. While we feel like Netgear needs to combine the cloud features into a single universal app with mirrored web page access, the extra options are appreciated. At full tilt, the 312 drew a high 53.1W from the wall.

Despite the high RRP, you can find the 312 online for under $350 with no drives.

HIGHLY apc RECOMMENDED

8/10

$399

BUNDLED DRIVE OPTIONS
BITTORRENT DOWNLOADING
BROWSER-BASED SETUP

QNAP TS-220

Packed to the clouds with features.

@ www.qnap.com
✓ Great apps, efficient, quiet
✗ No setup CD, front USB ports 2.0 only, average speed.

The TS-220 uses the popular 1.6GHz Marvell 88F6282 CPU, along with 512MB of DDR3 RAM. It's got dual bays that can house both 3.5-inch and 2.5-inch drives with a maximum capacity of 8TB. Connectivity is good, with a USB 2.0 port on the front (though we would have preferred USB 3.0) and two USB 3.0 connections round the back. You also have a Gigabit Ethernet port as well as two eSATA ports to handle extra storage.

After dropping in some drives, setup is simply done by pointing your browser at the online NAS finder and following the wizard. While there's a quick install guide, no setup CD is included, which honestly shouldn't be problematic, unless you're trying to set it up on a network without internet access.

Access speeds are right where we'd expect, given the spec. While it's not the fastest NAS on the planet, the TS-220 has plenty of throughput for even quite demanding home or office use.

You can access your QNAP NAS remotely from any browser, as well as via Android and iOS apps. Both apps give you access to your files and configuration options, plus they let you monitor the system status, such as CPU and RAM use. You can also manage your BitTorrent or FTP downloads and backup schedules. The TS-220 will also stream your music and video to your media player, smart TV or consoles.

The TS-220 is actively cooled with a fan, though it's very quiet in operation. It uses only a modest 22W, so it won't add much to your power bill if left running 24/7.

Sans drives you can buy the bare NAS for under $275 online, though some retailers do bundle it with drives starting from around $550. If you want fully featured cloud connectivity from your NAS, the TS-220 is a great buy.

BITTORRENT DOWNLOADING
DLNA MEDIA SERVER
FTP SERVER

7/10

$299

Shuttle OMNINAS KD21

A new NAS from an old favourite brand.

@ au.shuttle.com
✓ Easy setup, affordable, includes mobile apps.
✗ Slightly slow, drives need to be screwed in, single LAN port.

Shuttle has recently introduced its own branded NAS products: the OMNINAS KD20 and KD21. The KD21 is a dual-bay NAS that can support up to 8TB of total storage from both 3.5-inch and 2.5-inch drives in RAID 1, 0 or JBOD. It runs an embedded version of Linux, with a Marvell 88F6707 1GHz CPU and 512MB of RAM. It's got dual USB 3.0 ports and an SD card reader on the front and a single USB 2.0 port on the back, along with a Gigabit LAN port.

After populating the KD21 with dual drives, setup was dead easy, though the drives do need to be screwed into their hot-swap bays. Once the NAS is powered up, running the included CD finds the NAS and brings up the configuration tool. It takes about 5 minutes to click through the options, format the drives and be totally ready to rock and roll.

Our synthetic benchmarks put the KD21 a fair bit slower than more expensive options when writing, but gave good results for the spec and price. When copying large files, the KD21 made up ground and was only slightly slower on a mixed file copy.

The KD21 has an Android and iOS app for remote access to the app. The Apple app is a little more polished, but both are fairly easy to use and let you upload or download to your storage when on the go. It also works as a media server and can handle DLNA content or iTunes. It can even handle your torrents, run as a print server or you can set it up as your own FTP server.

The OMNINAS KD21 is fast yet fairly affordable, though as it's very new to market it can be hard to find for under the RRP.

HIGHLY apc RECOMMENDED

8/10

$349

- INTEL ATOM CE5315 CPU WITH GPU
- HDMI VIDEO OUTPUT
- S/PDIF AUDIO OUTPUT

Thecus N2520

A NAS and media centre in one.

@ www.thecus.com

✓ Efficient, fast, media playback via HDMI.

✗ Pricey, no 2.5-inch drive support, long setup.

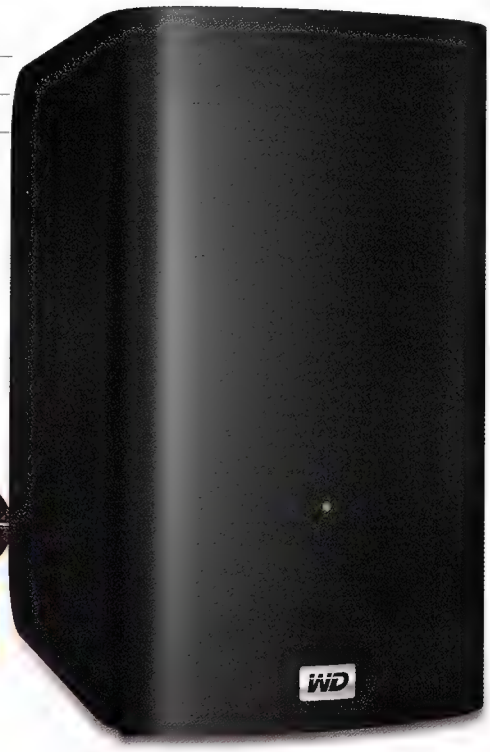
This Thecus NAS doesn't come with drives, but adding your own is easy, thanks to the tool-less bays and hard drive sliders. It handles two 3.5-inch drives in RAID 0, 1 and JBOD. Despite a promised 5-minute complete install, we found it took a solid 30 minutes to get the Thecus up and running, and we had to reboot before the software could find the NAS. You also have to actually install the software, rather than just running a finder program and configuring it through a web interface.

The N2520 uses the dual-core 1.2GHz Intel Atom CE5315 CPU (plus 1GB of RAM) and is actually the first NAS to do so. The Atom is a 32-bit processor with a GPU, meaning it can process HD video streams and even output them via the device's HDMI output. This means the N2520 can play media directly from its drives, rather than requiring a separate player and using up network bandwidth to stream it. It's also very efficient at 16W, reducing the power use without compromising on processing grunt. Access speeds are very respectable and are on par with much more powerful machines.

Round the back, the N2520 has dual USB 2.0 ports, HDMI, S/PDIF and Gigabit LAN, while a USB 3.0 port is located on the front. The NAS is designed to be hooked up to your TV, allowing you to manage files or browse the web. It can also replace your media player and can handle HD video playback.

The free T-OnTheGo Android and iOS app are quite good, letting you manage your files and folders, as well as open documents, view pictures and stream video. The Thecus also has an FTP and print server, it can handle your BitTorrent downloads and it supports media streaming.

If you shop around online, the Thecus can be found for under $300 (with no drives), making it a great choice as a combo NAS/media player.



- 4, 6 AND 8TB VERSIONS
- WD 2GO MOBILE APPS
- PASSIVELY COOLED

7/10

$499

Western Digital My Book Live Duo

Simplicity from the get-go.

@ www.wd.com

✓ Easy to use, good remote access, low power draw.

✗ Small Android glitches, USB 2.0 only, expensive.

Our My Book Live Duo test unit came preloaded with dual 2TB hard drives (4TB total), though you can also get a 6TB or 8TB version. The drives are also removable, so you can upgrade or change them yourself if desired. The specs are lower than many of its competitors, however, with an Applied Micro APM82181 CPU running at 800MHz and 256MB of RAM. On the plus side this means it uses very little juice, drawing just 13W in use. It has a single Gigabit Ethernet connection, as well as a single USB 2.0 port. It uses passive cooling, so make sure it's in a well-vented area with nothing on top.

The Duo is aimed at home users who might not have a lot of networking knowledge and is therefore extremely easy to set up. After plugging it in, Windows immediately recognised it and we were able to open its browser-based interface. Everything is logically laid out and even those without much computer savvy will find their way around. Using Western Digital's WD 2go system, you can also log into your NAS remotely over the internet with the same interface.

WD 2go also has Android and iOS apps, so you can access your files from your smartphone or tablet. Western Digital has a history of making excellent apps and WD 2go is no different, with an almost identical, easy-to-use experience on both platforms. Our only niggle is that on Android the app wouldn't connect to the NAS at first, but restarting the device fixed the issue. While WD 2go gives access to your NAS files, it also lets you access Dropbox, SkyDrive of Google Drive accounts from within the one app.

If you want a NAS that's ready to go out of the box and has excellent remote and mobile access, the My Book Live Duo is a solid, albeit expensive, choice.

6/10

$699

WUALA CLOUD STORAGE

DUAL GIGABIT LAN PORTS

2.13GHZ ATOM CPU

LaCie 5big NAS Pro

A monolithic slab of NAS.

@ www.lacie.com/au

✓ Powerful, fast, feature rich.

✗ Pricey, power hungry, noisy.

The 5big NAS isn't some low-powered, super-efficient NAS for backing up photos – it's monster storage aimed at small business owners or high-end home users. It features a 2.13GHz Intel Atom processor, 4GB of DDR3 RAM and five drive bays. It only handles 3.5-inch drives, though RAID 0, 1, 5, 5+ spare and 6 are supported. It has dual USB 3.0 ports, as well as two USB 2.0 ports and a VGA connector, just in case you want to plug in a monitor. Unlike lower-end models, the 5big NAS Pro has dual Gigabit Ethernet ports, which it can aggregate together for faster speeds.

Setup is as simple as running the wizard and following the prompts. Speeds were solid, but didn't particularly stand out, considering the high-end nature of the device.

The LaCie is no slouch when it comes to cloud connectivity and it has a range of options. You can access it via a browser from any PC or mobile device, but the best option is to use Wuala – LaCie's own cloud storage product. Wuala works like Dropbox, with the client available for Windows, Mac and Linux. Dragging and dropping files automatically copies them to the 5big NAS, whether on LAN or WAN. There are also Android and iOS apps, giving you access to your files on the go or backing up your photos as you take them. The Wuala apps are quite polished and easy to use, and they also let you stream music and video. The Android app seemed to have better codec support, with the iOS app unable to play certain files. You can also share your files via email links, making it easy for friends or family to access photos and more.

Of course, it can also download your torrents, run as an FTP or print server and supports Apple's Bonjour protocol, so sharing your iTunes library is easy. Churning along, the mighty LaCie uses 70W – as much power as a laptop. Grab one under $600 online sans drives.

7/10

$499

WEB, PRINT & FTP SERVER

DLNA MEDIA STREAMING

ESATA SUPPORT

Noontec Terra Master F4-NAS

A four-bay NAS on a two-bay budget.

@ www.anyware.com.au

✓ Affordable, four bays, decent speeds.

✗ No mobile apps, noisy, hard setup.

While Noontec may not be the first brand name that springs to mind when considering a NAS devices, the F4-NAS has a lot to offer. For a start, the specs are good – it uses a Marvell 1.6GHz CPU backed up by 512MB of RAM. It has four 3.5-inch drive bays and supports RAID 0, 1, 5 and 6. Round the back it has a single Gigabit Ethernet port, alongside USB and eSATA connections.

Setup was a little fiddly and we had to grab the latest software from the web site, rather than use the included CD. Speeds were competitive, though they won't blow you away. The cloud connectivity options on the Noontec are a little hard to decipher at first, but in reality they're not so different from other NAS devices. You can log in via the internet from any computer and manage your files, or upload and download what you need. It also supports automatic network backups and backups to the cloud. Sadly, no mobile apps are available, though you can still access your files over the internet via your mobile device's browser.

It can also handle serving media to your devices, such as streaming video to your TV via a DLNA media server. Out of the box it's compatible with the Xbox 360 and PS3, it can run as an FTP or print server, as well as download your torrents. It can also be an email and web server, handling 30 web sites – provided, of course, your internet connection is up to snuff. The Noontec NAS is on par with other devices for power consumption, averaging 32.3W under load.

While it's not the most powerful NAS around, the F4-NAS can hold its own with other models while still being affordable. If you want a solid NAS that you can populate with up to four of your own drives on the cheap, this is a good, reasonably priced option at around $450 online.

SYNOLOGY CLOUD STATION
TOTAL CAPACITY 20TB
MEDIA SERVER

8
10

$1,099

@ www.synology.com

✓ Fast, feature-packed, easy setup.

✗ Expensive, slightly noisy, probably overkill for most people

Synology DS1513+

Feature-packed for business or high-end home use.

The DS1513+ uses a dual-core 2.13GHz Atom D2700 CPU, with 2GB of DDR3 RAM that can be expanded up to 4GB. It's got five bays, which can take both 2.5-inch and 3.5-inch drives for a total capacity of up to 20TB. It supports RAID 0, 1, 5, 6, 10 and JBOD. The Synology is packed with connectivity options, thanks to quad Gigabit LAN ports and dual eSATA connections. It's also got four USB 2.0 ports, plus two USB 3.0 ports for high-speed access to external drives.

Setting up the Synology NAS was comparatively easy – we simply dropped in two drives, plugged it into the network and booted it up. No discovery software was needed (or included), with Windows immediately detecting the NAS and letting us launch the web page management system. From there it took just a few minutes to set up the NAS and get our drives formatted.

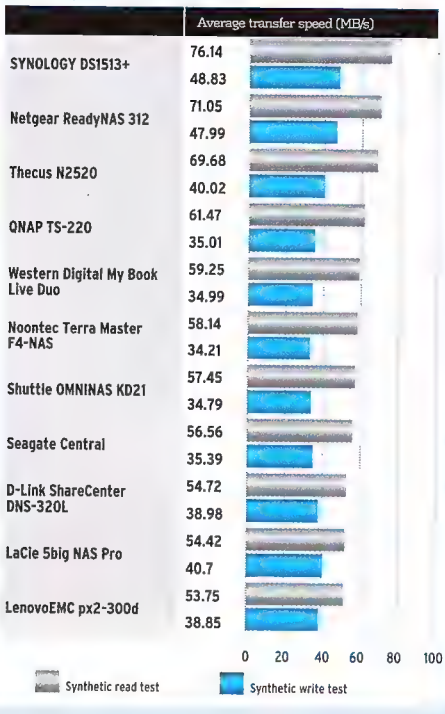
Cloud connectivity on the Synology is very good. Cloud Station lets you automatically share and sync data between computers, while DS Cloud does the same for your Android and Apple mobile devices. Generally the mobile apps ran well, though they're a little light on features for now (Synology is reportedly working to improve them). You can also access your NAS remotely from a browser using Synology QuickConnect. The DS1513+ can even serve media, run as a print or FTP server, host web pages, automatically back up computers or download your torrents.

The Synology runs dual fans, which can get mildly noisy under load, but they're generally fairly quiet. It averaged 48W when in use, but this would obviously be higher with more drives.

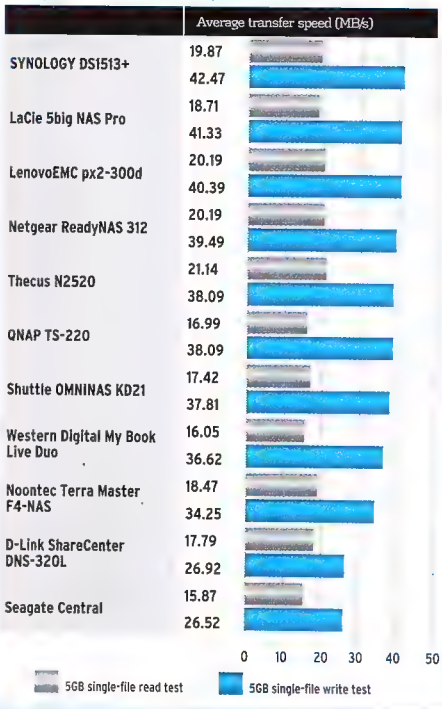
While the diskless DS1513+ is easy to find under $900, it's still an expensive option. However, if you need a high-end five-bay NAS for home or business purposes that doesn't skimp on speed or features, then it's well worth the money.

LABS CLOUD-CONNECTED NAS BOXES

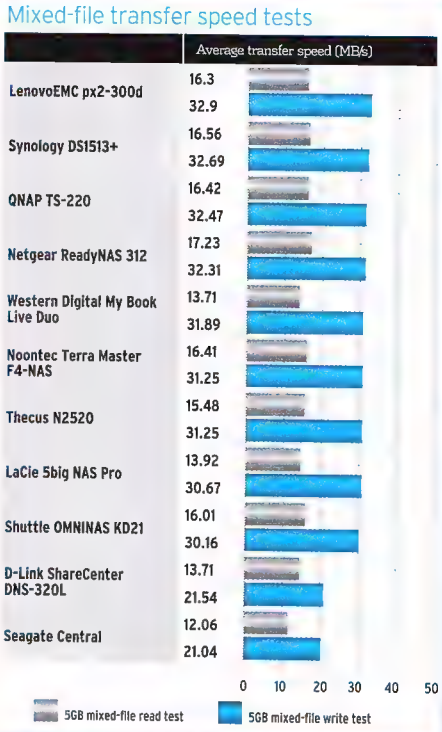
LAN Speed Test results


Average transfer speed (MB/s)
SYNOLOGY DS1513+ 76.14 48.83
Netgear ReadyNAS 312 71.05 47.99
Thecus N2520 69.68 40.02
QNAP TS-220 61.47 35.01
Western Digital My Book Live Duo 59.25 34.99
Noontec Terra Master F4-NAS 58.14 34.21
Shuttle OMNINAS KD21 57.45 34.79
Seagate Central 56.56 35.39
D-Link ShareCenter DNS-320L 54.72 38.98
LaCie 5big NAS Pro 54.42 40.7
LenovoEMC px2-300d 53.75 38.85
0 20 40 60 80 100
Synthetic read test
Synthetic write test

Single-file transfer speed tests


Average transfer speed (MB/s)
SYNOLOGY DS1513+ 19.87 42.47
LaCie 5big NAS Pro 18.71 41.33
LenovoEMC px2-300d 20.19 40.39
Netgear ReadyNAS 312 20.19 39.49
Thecus N2520 21.14 38.09
QNAP TS-220 16.99 38.09
Shuttle OMNINAS KD21 17.42 37.81
Western Digital My Book Live Duo 16.05 36.62
Noontec Terra Master F4-NAS 18.47 34.25
D-Link ShareCenter DNS-320L 17.79 26.92
Seagate Central 15.87 26.52
0 10 20 30 40 50
5GB single-file read test
5GB single-file write test

Mixed-file transfer speed tests


Average transfer speed (MB/s)
LenovoEMC px2-300d 16.3 32.9
Synology DS1513+ 16.56 32.69
QNAP TS-220 16.42 32.47
Netgear ReadyNAS 312 17.23 32.31
Western Digital My Book Live Duo 13.71 31.89
Noontec Terra Master F4-NAS 16.41 31.25
Thecus N2520 15.48 31.25
LaCie 5big NAS Pro 13.92 30.67
Shuttle OMNINAS KD21 16.01 30.16
D-Link ShareCenter DNS-320L 13.71 21.54
Seagate Central 12.06 21.04
0 10 20 30 40 50
5GB mixed-file read test
5GB mixed-file write test

NAS-READY HARD DRIVES

Preparing to build your own NAS? Bennett Ring tests 3.5-inch hard drives to see which are up to the task.

It's amazing how many homes now include a dedicated network. With every room now inhabited by several devices hungry for digital video, audio and picture files, home networks are no longer the sole domain of the networking nerd. At the heart of many networks is a network-attached storage (NAS) device, which is able to stream multiple files throughout the house, even when your main PC is sitting idle in a power-saving sleep mode.

The performance of these NAS devices is highly dependent on the hard drives housed within – use 5,400rpm creakers from 2004 and you may have issues streaming a 480p movie to your iPad, let alone multiple HD streams to several smart TVs. Unfortunately, your choices for NAS-ready hard drives are rather limited, although we've tested four ultra-large-capacity drives on the market to see how they compare.

WHAT'S A NAS DRIVE?

The majority of consumer NAS drives are almost identical to standard internal mechanical hard drives, with a couple of minor tweaks.

First and foremost, their firmware is optimised for RAID configurations, which is the most common installation method in a NAS. These optimisations focus on error recovery control, as the NAS's RAID controller can usually handle any error correction instead of the drive controller. Some NAS drives also remove any power-saving and head parking features, as they're designed to be active 24/7.

Cooler operating temperatures are desirable in NAS drives, too, as stacking several of these heat bricks next to each other (as they are in many NAS box enclosures) can present a thermal challenge.

The more expensive NAS drives tend to feature higher levels of performance than desktop models, enabling the NAS to serve multiple simultaneous clients without performance woes. The capacity of NAS drives also tends to be larger than standard mechanical drives.

RAID YOUR DRIVES

There's one final point that Western Digital has emphasised with its new Red line of NAS drives – they're guaranteed to work in a RAID setup, whereas some desktop drives are averse to RAID, such as the Western Digital Green series. However, this is a bit of a rarity – most desktop drives will be fine in RAID mode.

WHICH DRIVE?

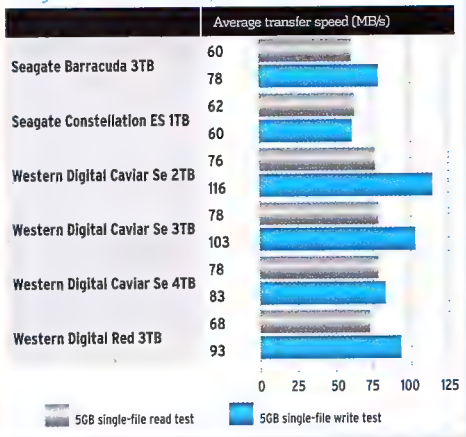
So, should you buy a dedicated NAS drive for inclusion in your NAS device, or will a standard desktop hard drive do the job? Our advice is to go for the NAS drive if you don't mind paying the slight premium in price because it guarantees the best possible performance and compatibility. However, if your NAS is being built on a peanut budget, you can still use desktop drives. Just make sure they're happy to play in your chosen RAID mode and with your selected NAS enclosure.

TOSHIBA & HITACHI: MISSING IN ACTION

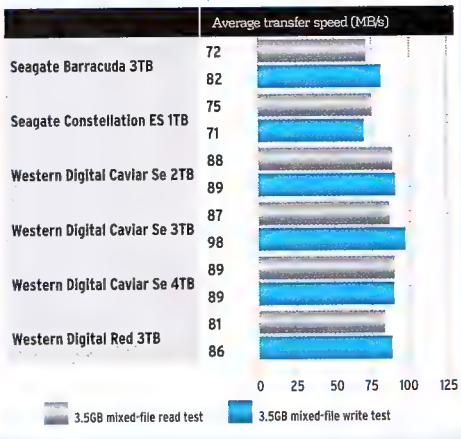
Despite our best efforts, we were unable to source any Toshiba or Hitachi drives for this feature. Toshiba's official PR firm informed us that they don't handle hard drives in Australia, while Hitachi's PR reps repeatedly ignored our emails. We then contacted the major Australian IT distributors we usually work with, but even they were unable to supply any drives. The fact that these companies don't appear to be interested in promoting their drives in Australia means it's impossible for us to recommend either company's options.

LABS HARD DRIVE TRANSFER SPEED TESTS

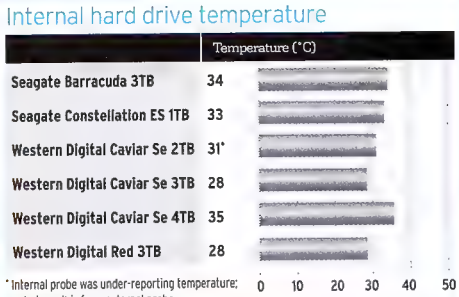
Single-file transfer speed tests



Mixed-file transfer speed tests



Internal hard drive temperature



* Internal probe was under-reporting temperature; quoted result is from external probe.

7/10

$145

7,200RPM
64MB CACHE
SATA 6GBPS

Seagate Barracuda 3TB

Can this desktop drive deliver?

@ www.seagate.com

✓ Great price.

✗ Slowest performance, higher operating temp.

Released back in 2012, this was the first of Seagate's range of drives to start using 1TB platters. Each of these platters spins at a healthy 7,200rpm and it's actually intended as a desktop drive. However, considering that 3TB NAS drives are harder to find than hens' teeth at a chicken farm that uses sugar as feed, we decided to include it on these pages to see how it'd compare to the other drives.

The nicest comparison is price. At just $145, this drive is very affordable considering the 3TB capacity. It's built to save energy, with the dual-core LSI disk controller including several power-saving features. Its 64MB of DDR2 memory serves as the disk's cache, while a SATA 6Gbps connection delivers connectivity. Our performance tests show that the Barracuda isn't going to set your storage world on fire. It came in last place in all of our tests, which proves the old adage that you pay for what you get. Despite the slower performance, it managed to record the second highest operating temperature during our tests, at 34°C.

We can't complain about the cost, although it's obvious that the Barracuda isn't quite in the same league as true NAS drives. If you're not running a demanding network it'll probably be fine, but if you need to service a bunch of clients all streaming HD content, you're going to need to spend a little more.

6/10

1TB $155

2TB $259

AES-256 OPTION
SATA 6GBPS
7,200RPM

Seagate Constellation ES 1TB

A blast from the past.

@ www.seagate.com

✓ Five-year warranty.

✗ Very expensive, old technology, very slow.

Unfortunately, we could only source a 1TB sample of this drive, although it's available in 2TB and larger capacities at retail. If the Western Digital Se drive is anything to go by, the performance of the smaller drive capacity should be faster than the larger drives, so the results here potentially show the ES in its best light. As you can see from the woeful test results, that's not saying much. By hard drive standards it's a bit of a dinosaur, released way back in 2010, but it speaks to the difficulties of finding SOHO NAS drives that this was one of the few drives we were able to source.

As expected, this is another 7,200rpm unit, which appears to be the de facto standard for NAS hard drives. It has the usual 64MB of DDR2 memory for a cache, which is also the standard across all of the drives we tested. Seagate claims this drive is aimed at Enterprise users and the price backs up those claims. Sadly, the performance doesn't. As our benchmarks attest, this drive is actually slower even than the Barracuda drive from Seagate and well behind Western Digital's offerings. It was probably quite respectable back in 2010, but times have changed. However, the five-year warranty is worthy of an Enterprise drive and Seagate claims that the Constellation ES is also blessed with the reliability levels expected from this kind of drive.

Unfortunately, we just can't justify this drive for SOHO users. Compared to Western Digital's Se series, the performance is wholly inadequate, while the price is far too high.

TESTING METHODOLOGY

We were initially going to test each drive within a NAS enclosure, but realised that this would likely limit the performance differences between the drives, as the NAS's Ethernet connection would be the limiting factor. Instead, we decided to assess each drive on a standard PC test bench, as this would let us see precisely how each drive performed. Our test bench consisted of an Intel Core i5-3570K CPU in a Gigabyte GA-Z77X-UD3H motherboard, paired with 8GB of DDR3-1600 RAM in dual-channel mode. Our OS/file drive was the Kingston HyperX SSD running off SATA 6Gbps, while AMD's Radeon HD 7970 took care of video duties. Finally, we used

THREE-YEAR WARRANTY
24/7 PHONE SUPPORT
64MB DDR2 CACHE

9/10

$175

EDITOR'S CHOICE apc

Western Digital Red 3TB

The darling of the NAS world.

@ www.wd.com

✓ Good performer, low temperature, good value.

✗ Not a total speed demon.

The Red series from Western Digital currently have the hottest drives among NAS users and we don't mean that literally – our temperature test showed this little chiller peaked at a mere 28°C. We're referring to how damn popular the Red series is. Western Digital recommends this drive for NAS devices of five bays or lower, with the more expensive Re and Se series for larger capacities.

As a true NAS drive, the Red includes a couple of features that you won't see on desktop drives. For starters, the Time Limited Error Recovery system allows speedy RAID controllers to handle error correction, while vibrations are reduced due to dampening technology included within. Finally, head parking has been disabled, which means the drive should react instantly to requests, unlike desktop drives, which put the head down whenever they're not in use.

Heading to the performance tests, we see that the Red thoroughly outclassed the desktop Seagate drive, but fell behind WD's expensive Se series. At $175 for the 3TB version, you'll pay a slight premium compared to the Seagate drive, but it's a very small price to pay given the healthy performance boost. Throw in a generous three-year warranty and we can see why the Red is the current NAS device of choice for home NAS owners.

HIGHLY apc RECOMMENDED

7,200RPM
FIVE-YEAR WARRANTY
SATA 6GBPS

8/10

2TB $179

3TB $260

4TB $329

Western Digital Caviar Se 2TB, 3TB & 4TB

Are enterprise drives suitable for home?

@ www.wd.com

✓ Excellent reliability and warranty, fastest performance.

✗ High price, very warm.

As you can see from the premium pricing, the Se series isn't your average SOHO NAS drive. Built for high-end Enterprise users, we wanted to see just what difference a doubling of price would bring. Unfortunately, the biggest changes aren't possible to see during performance testing.

These drives are designed first and foremost for data safety. A variety of features should ensure that drive failures are much rarer on the Se series than other NAS drives, including the NoTouch recording head that doesn't actually touch the platter, lowering wear and tear.

Each platter spins at 7,200rpm, while the standard 64MB cache helps to improve performance. Western Digital claims its proprietary Rotary Enhanced Feed Forward (RAFF) technology delivers significant performance increases, which were borne out by our benchmarks. The Se series delivers impressive performance, although the results varied greatly depending on the capacity of the drive. The smaller the drive the faster it performed, with the 2TB drive having a 40% performance increase in some tests. On the flipside, the price per gigabyte obviously decreases as the drive capacity gets larger, so which model you choose will come down to your focus: price or performance.

If you need the ultimate in reliability, not to mention performance, the Se series will do the job in a home NAS device. You're going to have to pay for it, though, but considering how important much of the data we save on our NAS devices is (wedding photos? Newborn baby videos?), many will find the price premium easy to justify. apc

Windows 7 64-bit. Instead of using synthetic benchmarks, we decided to perform four real-world tests that would accurately show how each drive handles normal NAS duties. The first two measured the sequential read and write performance of the drive, copying a single 5GB file to and from the SSD. The final two tests looked at the drive's performance when handling mixed file sets, copying 3,500 files totalling 3.5GB, both to and from the drive. As you'll see, the results varied substantially among the drives. Temperatures were measured after a sustained 10-minute file copy using HWMonitor to read the internal temperature. This was double-checked with an infra-red thermometer on the bottom of the drive – only one of the drives had an external temperature several degrees hotter than the software reported.

NAS IT YOUR WAY

Buying an off-the-shelf product isn't the only way to add a NAS to your network: you can make one yourself. Ashton Mills shows you how.

While there's a wide range of NAS products available to help you quickly and easily add a NAS to your network (see our reviews starting page 41), there is another way. For a start, while turnkey solutions, these products can be expensive for what you get. Moreover, depending on the product, you may be locked in with that vendor when it comes to accessing the data on your NAS, should the hardware fail – *APC* staff have experienced first hand the problem of plugging in hard drives from a NAS into a PC in order to recover data, only to find them unreadable.

For these reasons and more, building your own NAS box can be a big plus, with the added bonus of giving you full control over the configuration and features of the machine. It's also a great project if you feel that itch to create something and expand your skill set along the way – some people have even ventured to make one using a Raspberry Pi!

So first up, what hardware makes a good NAS?

THE HARDWARE

As it happens, a NAS box isn't defined so much by the hardware and it doesn't have to be powerful – you can use anything from a low-power fanless mini PC to a full-tower server if you wish, just as long as it can run your choice of operating system. For this reason, you can go the route of building a box from scratch (using a mini PC chassis and micro-ATX-based motherboard, for example) or to save time, buy premade machines that have (and use) less power than a standard desktop PC, but are well-suited to NAS duties. These can include products like Shuttle's range of compact PCs or mini servers like those from HP going cheap online. Or you can recycle an older PC that's lying around just waiting to be put to good use again.

Indeed, your average NAS doesn't need a lot of CPU grunt or memory, which is why many commercial NAS products are outfitted with Atom CPUs and 2GB or less of RAM. The only real requirements are space for at least two hard drives and that the CPU is x86-based. There's nothing stopping you using an ARM-based solution (as with a Raspberry Pi), but for this guide we're going use a flexible x86-based Linux distribution called OpenMediaVault (OMV).

THE SOFTWARE

Interestingly enough, commercial NAS products almost always use Linux themselves, bundled with their own web-based front end to configure and manage the device. Some of them are very good, but you pay a premium for the whole hardware/software package and you can get all the same functionality out of OMV and similar free products (see 'Alternatives to OMV' on page 47).

Because a NAS operating system is inherently lean – it doesn't need a GUI weighing it down, for starters – there are two different options when it comes to installing OMV.

- **Install to a hard drive.** This is the simplest, but it has a drawback. Whatever drive you use for OMV must be dedicated solely to OMV, which means it can't be used as device to store data for your NAS. And since OMV is quite small (about 750M after installation), dedicating a large hard drive to OMV would be a waste of space. You can use an SSD as the OS drive, which may be useful for compact PC cases as SSDs are physically small as well, but even a cheap 64GB drive is technically overkill (at least it should last forever with so much space for wear-levelling routines). Incidentally, even popular alternatives like FreeNAS (again, see 'Alternatives to OMV') have the same limitation.
- **Install to a USB device.** Installing to a USB key or drive is therefore not only viable, but probably preferred... with a few caveats. OMV can install to and run from a USB device just fine, even though booting from USB is slower. Doing this has another advantage, too: it won't occupy a hard drive slot. If your enclosure only has space for four hard drives, for example, dedicating one to the OS would prevent you from using it for storage. However, the main caveat is that if you use a USB key – small, efficient, can plug unseen into the back – you'll need to replace it semi-regularly, as USB keys are notoriously unreliable over long periods, especially when used as OS drives, due to the volume of writes. A powered external USB hard drive, even a small one, is more reliable yet also larger and may cramp your style if you want a self-contained compact box as a server.

Plan on your choice before you begin. If you only intend to use two drives for storage and mirror them in RAID 1 for redundancy, for instance, but there's space for three hard drives in the box, the first option is probably best. If you want to use four drives and these fill the spare slots in the chassis, buy a quality USB key or external USB drive to use for the OS.

YOU'LL NEED THIS

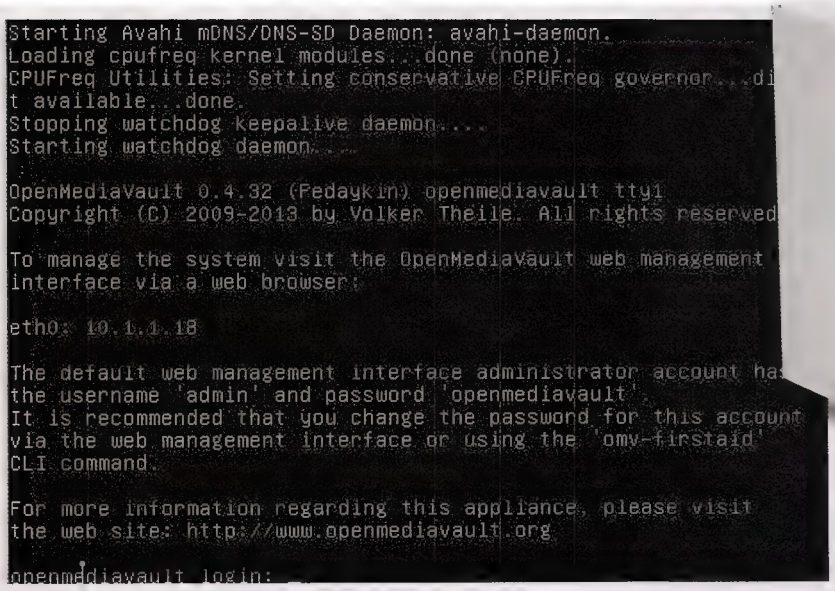
OpenMediaVault – www.openmediavault.org
Spare PC – pre-fab or home-built mini
Hard drives – at least two!
USB key – any size will do

INSTALLING OMV

Start by heading to **www.openmediavault.org** to download the latest ISO image of OMV. If you don't have an optical drive in your NAS box, you'll need to image the ISO to a USB key for booting and installing. Any size will do – the install image is only around 250MB. To create a bootable USB drive, you can use UNetbootin in either Linux or Windows: for Windows, head to **unetbootin.sourceforge.net**; for Linux, it can usually be found in your distribution's repositories (search for UNetbootin in Ubuntu's 'Software Center').

Once this is done, plug it into your NAS box, plug in a monitor (you can remove this later once it's installed), make sure the BIOS is set to boot USB devices ahead of any hard drives (see the manual for your box or motherboard for how to enter the BIOS) and turn it on. It's also important to make sure the network cable is plugged in before you begin.

OMV will load to a console screen and request a login, although you don't need to. From here on in, all configuration and management can be done via the web-based interface – note at the console what address has been acquired via DHCP over your network (for example, 10.1.1.18). To load the OMV interface, simply type that address into a browser on


Starting Avahi mDNS/DNS-SD Daemon: avahi-daemon.
Loading cpufreq kernel modules...done (none).
CPUFreq Utilities: Setting conservative CPUFreq governor...di
t available...done.
Stopping watchdog keepalive daemon....
Starting watchdog daemon....
OpenMediaVault 0.4.32 (Fedaykin) openmediavault tty1
Copyright (C) 2009-2013 by Volker Theile. All rights reserved
To manage the system visit the OpenMediaVault web management
interface via a web browser:
eth0: 10.1.1.18
The default web management interface administrator account ha
the username 'admin' and password 'openmediavault'.
It is recommended that you change the password for this account
via the web management interface or using the 'omv-firstaid'
CLI command.
For more information regarding this appliance, please visit
the web site: http://www.openmediavault.org
openmediavault login:

OpenMediaVault booted up and running – no GUI, all managed via a web browser.

Building your own NAS can be a fun project and stylish, too, with cases like this one from Fractal.

another computer. You can simply log in using 'admin' for the username and 'openmediavault' for the password.

FIRST STEPS

Start by clicking 'General Settings' under 'System' from the left-hand menu, followed by the 'Web Administrator Password' tab on the right. Change the password from the default 'openmediavault'. This password is different from the system root password you set during install, which you generally shouldn't need to use.

Next, make sure OMV is updated by clicking on 'Update Manager' under 'System'. There may already be updates pending; simply click the box at the top to select all and install them. Reboot OMV by clicking on the gear icon drop-down at the top-right.

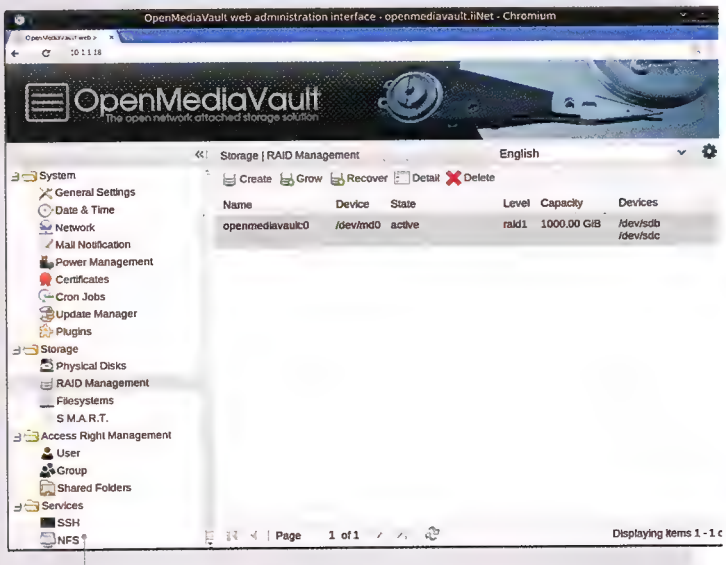
Log in again and it's time to set up your drives.

DRIVE SETUP

Under 'Physical Disks' in the 'Storage' are, you'll see the detected drives in your system. If you have more than one drive, you can RAID them using Linux's own built-in software RAID. Here we have a number of recommendations.

- If you have two drives, we recommend using RAID 1, aka mirroring. Your total capacity will be limited to the size of one drive, but should one drive fail you'll have a complete backup on the other.
- If you have four drives, you can opt for RAID 10 or RAID 5. Even though RAID 5 is a viable option, we recommend using RAID 10 – RAID 5 is more demanding for system resources and slower for writing, it's less resilient than RAID 10 and there's more work involved to recover data if the drives are moved to another system (they require the array to be rebuilt first). However, RAID 5 is more space-efficient. Four 1TB drives will net you 2TB of space under RAID 10 or 3TB under RAID 5.
- If you have more than four drives then you have a rather nice NAS, for a start! As RAID 10 requires pairs, RAID 5 may prove better, especially for odd numbers (ie. five drives), although the more drives you have, the more demand is placed on system resources.

There are some other options OMV offers: RAID 6, which is RAID 5 with extra parity for better data redundancy, although this requires an extra drive without increasing the maximum capacity, and RAID 0, which is also known as striping. While RAID 0 can be attractive for desktop systems given its raw performance, this is completely wasted in a NAS. Aside from the fact that if one drive should die, you'll lose all your data – and presumably you're building a NAS for reliable storage – any speed benefit RAID 0 provides is lost as even Gigabit Ethernet is saturated by



RAID 1 built from two 1TB drives. Great for redundancy.

the speed of a single drive. However, in a two-drive NAS it will give you the full capacity of both drives.

To create the RAID, tap 'Create' under 'RAID Management', give it a name, select the RAID level and tick the drives. After the array syncs, head to 'Filesystems' on the left, click 'Create' again, select your RAID and choose the file system to use – Ext4 is the standard, although XFS and JFS are options if you're familiar with them. All three are readable by your average modern Linux machine, so if the worst should happen and your system carks it, plugging the drives into another PC will still allow you to access your data.

Finally, before moving on, select the new file system and then click the 'Mount' button.

SETTING UP A SHARE

Select 'Shared Folders' under 'Access Rights Management'. Click 'Add' to add a new shared folder, give it a name and a path (a directory will be made for you), select your mounted file system on the RAID and click 'OK'. The default access permissions from the drop-down box are that the administrator and user logins you create have write access, but

everyone else can only read. Set this to 'Everyone:Read/Write' initially to make sure that the share works properly over the network, or if you don't care to have access controls and just want a simple easily accessible share.

Next, to share this folder over the network, click on 'SMB' (Server Message Block, aka Windows networking) under the 'Services' section and then tick 'Enable' to start sharing. If you want the NAS to join your current Windows network Workgroup, change the workgroup name; for basic sharing you don't need to do anything else here and the defaults are good. Click 'OK' at the bottom.

We're almost done. With the Windows network sharing service having started, you then need to share the folder itself. At the top you'll see a tab called 'Shares' – click on this followed by 'Add' to add a new share. Give it a name (this is what you'll see when browsing the network) and select your shared folder. Finally, tick the 'Public' box so you don't need to enter a password whenever you connect and click 'OK'.

And that's all there is to it – your NAS is ready to rock. If you browse the local network from your Windows or Linux boxes, you should see the share show up. Of course, there's plenty more to play with, so lets explore some of the options.

NATIVE LINUX SHARING

Linux boxes have no problem working with Windows shares, so enabling SMB is all you really need to do. However, Linux does have its own network sharing protocol called NFS (Network File System). NFS is easier to set up than SMB and often faster, too; in fact, in recent kernels you can set up an NFS share as *swap* for your local operating system.

To set up an NFS share, click on the NFS service, tick 'Enable' to start it and then under 'Shares', click 'Add' as with setting up an SMB share. You'll notice that it's simpler to configure and the only option that needs explanation is the 'allowed clients' field: for this you can use a subnet mask with CIDR (Classless Inter-Domain Routing) notation to cover all the machines in your local network. For example, if your network and the NAS is on 192.168.1.0, using 192.168.1.0/24 will allow any machine on this subnet to connect.

Note that you need to make sure the 'nfs' module is loaded locally on any client machines to access the share, which not all Linux distributions will do by default. If you can't immediately see the share over the network, open up a terminal and run `sudo modprobe nfs` .

RESTRICTED SHARES

To create restricted shares – that is, have users require a login to access – there are a few extra steps.

Click 'User' under 'Access Rights Management', hit 'Add' and add your users. Next, go to your shared folder and click 'Privileges'. Give users 'Read' or 'Read/Write' access as you see fit. Then click 'ACL' and do the same. Finally, head back to your SMB share, click the 'Shares' tab, edit the share and deselect 'Public'. Alternatively, you can leave the share publicly accessible, set 'Others' to 'Read-only' under the ACL for the share and create a username that matches your own, and then give yourself 'Read/Write' access, thereby allowing only you to write while others can only read.

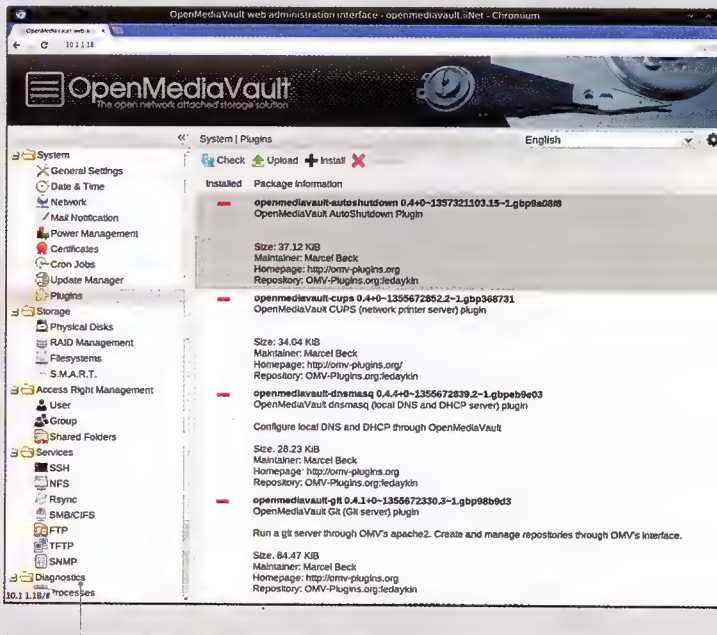
PLUG-INS

NAS operating systems often come with extensible functionality enabled through plug-ins and in this way, OMV is no different. These plug-ins can include simple features like enabling iTunes streaming or Apple file sharing, to more advanced services like BitTorrent and media encoding – after all, the NAS is still a computer. There's a even a guide for setting up a *Minecraft* server for OMV (visit the tutorial at **tinyurl.com/n6tc9ts** if you're interested!).

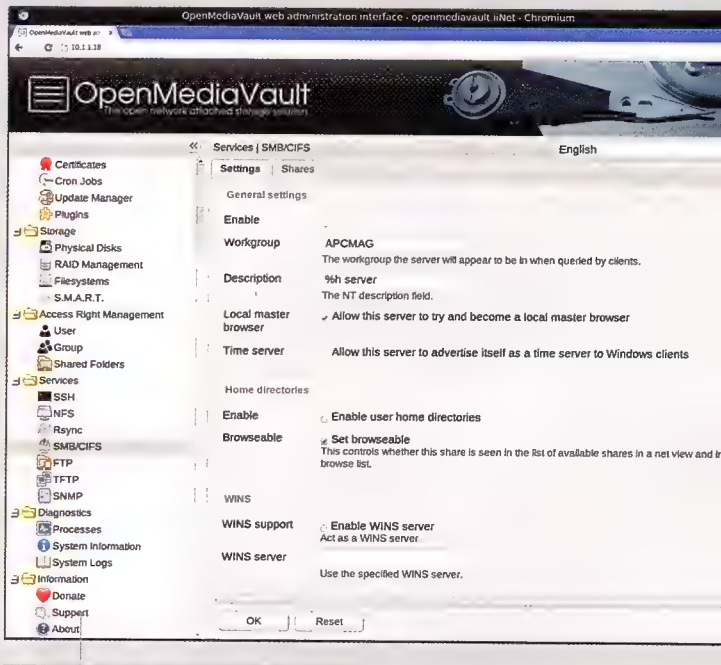
OMV has some of these already available under the 'Plugins' section, although there are also some great third-party plug-ins provided by users. A good place to start is the 'Unofficial Plugin' list at **tinyurl.com/m8gwlpc**. This includes Transmission for BitTorrent and an auto-shutdown function for when the NAS is idle. These plug-ins can also be installed through OMV by installing the OMV-Plugins plug-in itself, which you can find at **packages.omv-plugins.org**. Just download the DEB file and upload it in OMV via the 'Plugins' page to enable it.

The popular Plex media server, although it's technically just installed alongside OMV, can also be added with the help of a short guide at **tinyurl.com/k3ndmpu**.

Finally, while it hasn't been made into a plug-in yet, you can also add ownCloud (**owncloud.org**) cloud support by following the instructions at **tinyurl.com/l695njl**.



Optional plug-ins range from antivirus to BitTorrent and more.



Setting up a Windows network share for public access.

SETTING UP PERMANENT LINKS

It can be helpful to set up permanent links to your shares on the NAS to save browsing the network every time. To do this with Windows, find the share on the network, right-click the share and select 'Map network drive'. Easy.

Linux is similar. Under Ubuntu, open up Nautilus and click on 'Browse

Monitor the performance of your NAS with pretty graphs.

ALTERNATIVES TO OMV

OMV isn't the only free NAS option available. Another popular choice is FreeNAS (**www.freenas.org**) and its fork NAS4Free (**www.nas4free.org**). Unlike OMV, FreeNAS and NAS4Free are BSD-based, which is similar, but still quite different to Linux – if you're a command line junkie you'll find some concepts and commands the same, while others will be foreign.

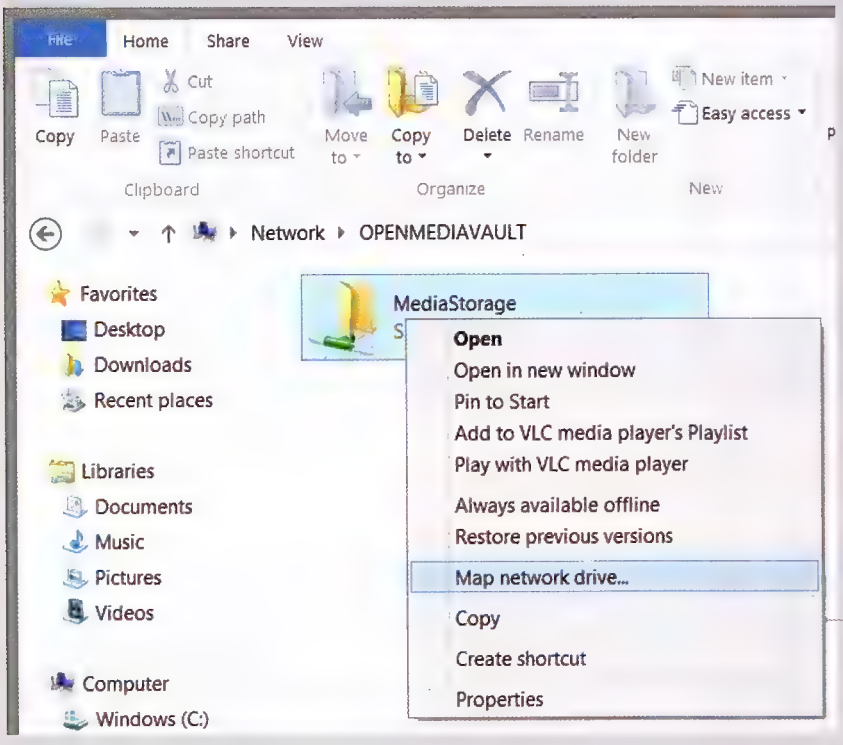
We actually tested FreeNAS for our guide first, but ran into various hardware compatibility problems with one of the two hardware test benches on hand. However, it may work fine for your needs. One advantage is that the download image is a preinstalled system and extracting it to a USB drive gives you a bootable OS ready to go.

CryptoNAS (**cryptonas.org**), as the name implies, makes it easy to set up a NAS-like file server with encrypted volumes. It's not as fully-featured as OMV or FreeNAS, but it's simple to get running.

Finally, Ubuntu Server (**www.ubuntu.com/download/server**), or any server version of a Linux distribution, will work just as well as any packaged NAS product. Additionally, OMV can be installed on top of it, which means you can create your own Ubuntu Server and OMV installation. We haven't tried this, but technically all you need to do is add the OMV repository and install:

```
sudo -s
echo "deb http://packages.openmediavault.org/public fedaykin main" > /etc/apt/sources.list.d/openmediavault.list
apt-get update && apt-get install openmediavault-keyring postfix
apt-get update && apt-get install openmediavault omv-initsystem
```

One advantage of doing this is that as the OMV distribution is based on Debian Squeeze, which is getting a little long in the tooth, using a newer Linux distribution as a base will allow for more recent hardware support as well as performance improvements from newer kernels.



Setting up a mapped network drive for the NAS in Windows.

Network' under the 'Network' heading. Find the share, click on it to mount it first, then right-click on the mounted share and select 'Add Bookmark'. The process is similar for KDE, though like Windows, you can select 'Add to Places' from the share itself without the need to mount it.

THINGS TO SEE

There's plenty more to explore in OMV. Check out 'System Information' under 'Diagnostics' for general system statistics, including the current CPU and memory load, as well as a summary of enabled services and some excellent performance graphs for system resource and disk usage. Use the 'System Logs' section to keep track of any issues or keep an eye on user logins.

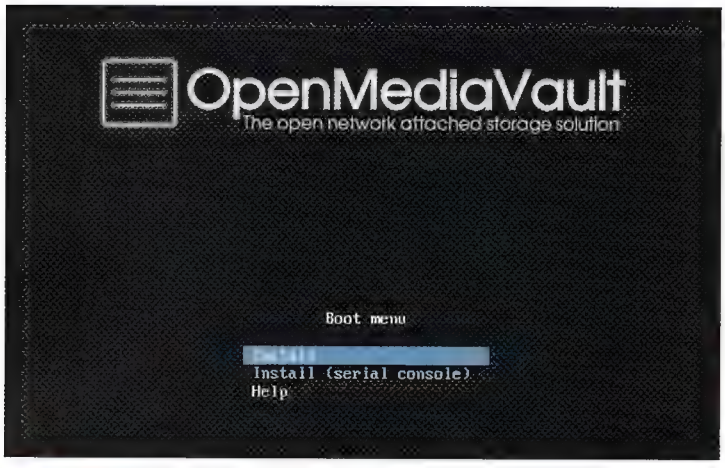
There's excellent SMART support under 'Storage', where you can view SMART data for your drives or set up regular SMART checks. Meanwhile, in 'Physical Disks' you can click 'Edit' on your drives to set advanced power management and acoustic options, along with a spindown time to power down drives while idle.

Of course, then there are other services, such as SSH for secure logins, FTP and TFTP, and Rsync for backups. With a little setting up you can configure Rsync to regularly backup data *from* clients on your network to the NAS for automated system backups.

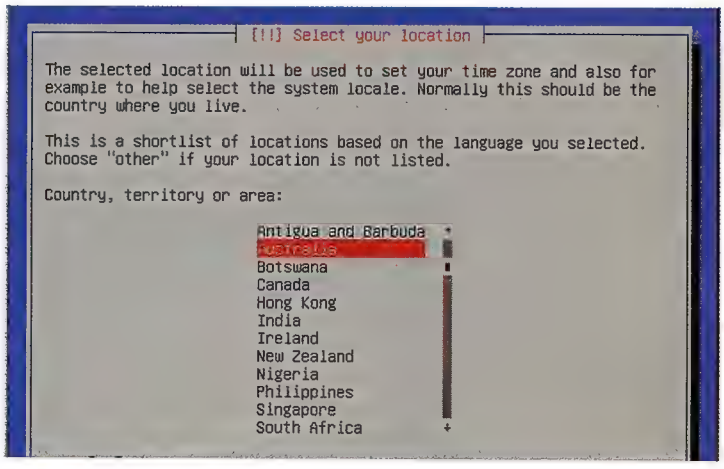
Finally, although OMV is free, if you like using it send some feedback via the support pages or donate to help continued development. And have fun with your NAS!

SET UP OPEN MEDIA VAULT

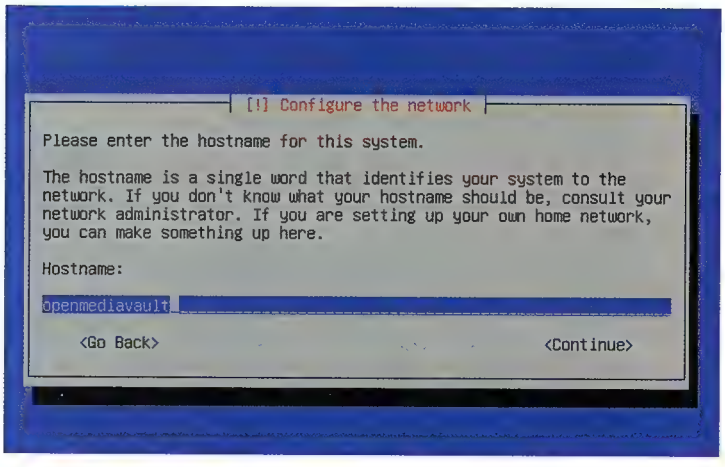
Get the program up and running on your NAS.



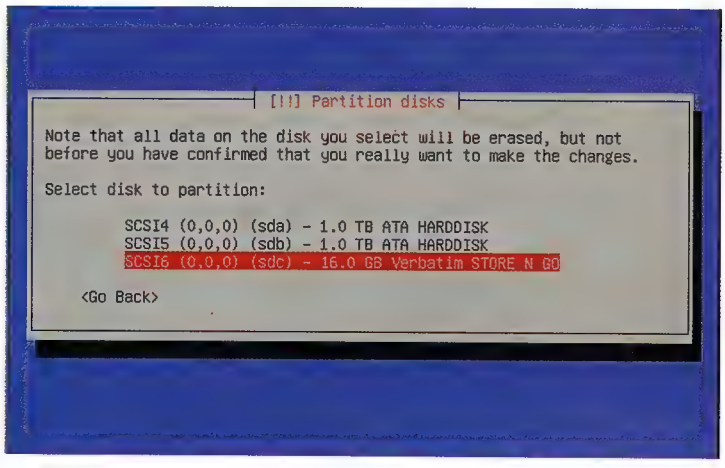
01 You should see the OMV boot menu appear – hit Enter to select 'Install'.


[!!] Select your location
The selected location will be used to set your time zone and also for example to help select the system locale. Normally this should be the country where you live.
This is a shortlist of locations based on the language you selected. Choose "other" if your location is not listed.
Country, territory or area:
Antigua and Barbuda
Australia
Botswana
Canada
Hong Kong
India
Ireland
New Zealand
Nigeria
Philippines
Singapore
South Africa

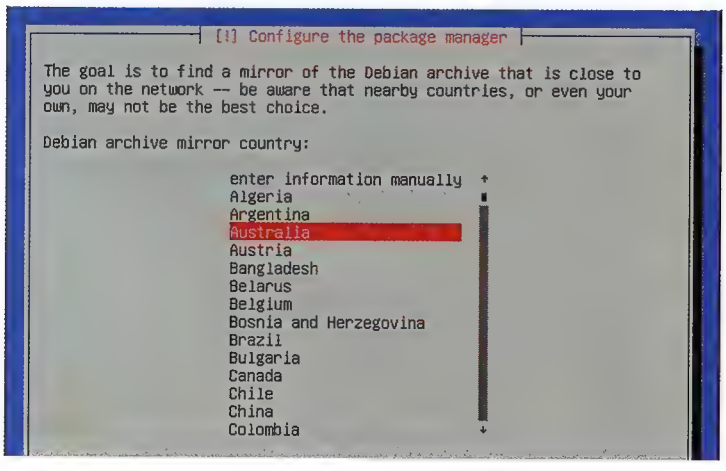
02 Choose your language, location and keymap ('American English' is fine).


[!] Configure the network
Please enter the hostname for this system.
The hostname is a single word that identifies your system to the network. If you don't know what your hostname should be, consult your network administrator. If you are setting up your own home network, you can make something up here.
Hostname:
openmediavault
<Go Back>
<Continue>

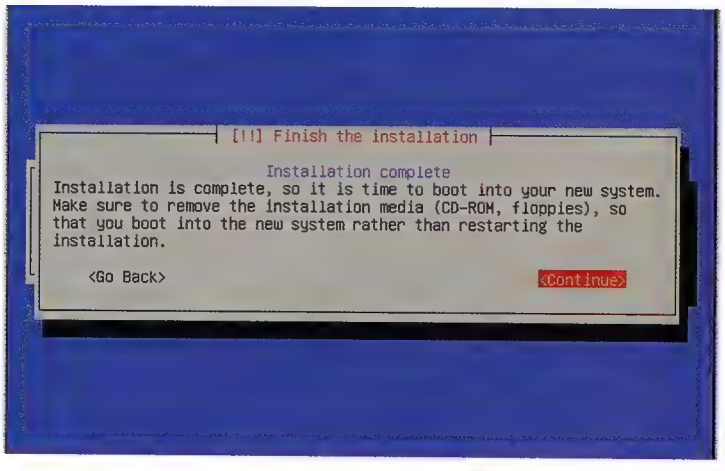
03 Choose a hostname and domain name (the defaults are OK) and set a root password. Write this down!


[!!] Partition disks
Note that all data on the disk you select will be erased, but not before you have confirmed that you really want to make the changes.
Select disk to partition:
SCSI4 (0,0,0) (sda) - 1.0 TB ATA HARDDISK
SCSI5 (0,0,0) (sdb) - 1.0 TB ATA HARDDISK
SCSI6 (0,0,0) (sdc) - 16.0 GB Verbatim STORE N GO
<Go Back>

04 After setting a timezone, you'll be prompted where to install OMV. If you're installing to a USB key or drive, check that your choice matches the name of the device. Note that any data already on the drive will be lost.



05 Choose the closest archive mirror next – if you're with Optus or iiNet, you can save data from updates counting towards your bandwidth cap.


[!!] Finish the installation
Installation complete
Installation is complete, so it is time to boot into your new system. Make sure to remove the installation media (CD-ROM, floppies), so that you boot into the new system rather than restarting the installation.
<Go Back>
<Continue>

06 Packages will be updated and then you'll be asked to remove the install media and reboot. OMV is now installed!

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- ***HDMI Output** for Multimedia Playback*
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20dB Ultra Quiet

5 min Complete Installation

Self-RAID Creation

intel Atom inside

N2520/N2560

N4520/N4560

Mobile Access

Photo Server

Media Streaming

Cloud Service Backup

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GAMING ON A TIGHT BUDGET

With the Aussie dollar falling, prices are on the rise. Darren Yates shows how to keep the budget intact with a $900 gaming box.

The booming Aussie dollar has meant we've enjoyed reasonable PC component pricing for much of the last year, despite the Federal Government's recent House of Representatives Inquiry into IT pricing (**tinyurl.com/l429mew**), revealing we've probably been paying too much. It states that some 50 hardware products were compared, with some average prices 46% more expensive than in the US. Whether that included PC components is unclear. Whatever the case, with the dollar having fallen, the cost of consumer electronics (including PC components) is on the rise again. That makes it more difficult to stretch the budget and maintain the same level of performance.

So this month, we set ourselves the goal of trying to create a new-generation system build for around $900. It's not easy, but it can be done if you're judicious in your component choices.

KEY COMPONENTS

With only $900 to spend, you don't have the luxury of choosing everything from the top shelf, so it's important to put the cash where it does the most good. The four key component areas in a gaming PC are the CPU, graphics card, motherboard and PSU. We've come up with two builds this month: one for Intel lovers and one for AMD devotees. Here's how they come together.

INTEL BUILD

PROCESSOR: INTEL CORE I5-4430

We've gone for Intel's Core i5-4430 Haswell-class quad-core CPU here. Quite simply, it's the cheapest Haswell chip there is until we see the Core i3 models. The good thing is this chip will happily drive any graphics card you throw at it for at least the next couple of years, so there's plenty of life in it, despite the fact we're building a budget system. Also, it'll be harder to replace the CPU than a graphics card in the future, so it's better to get a bit more than enough now.

GRAPHICS CARD: NVIDIA GEFORCE GTX 660

With such a tight budget, you want to maximise performance and keep realistic expectations, so we've gone for Nvidia's GeForce GTX 660. There are a number of cards around this price point: the GeForce GTX 650 Ti BOOST, AMD's Radeon HD 7850, even going up to the HD 7870 or GTX 660 Ti. The GTX 660 sells for just over $200 – you can obviously spend more, but you'll have to skimp elsewhere to stay under budget.

ASK US!

Looking to make your perfect PC, but not sure what parts to buy? Every month, our PC expert Darren Yates solves a readers' PC building quandary. Email us at apcmag@futurenet.com for your chance to get building!

MOTHERBOARD: GIGABYTE GA-B85M-D3H

While most gamers will head for Intel Z87-chipset boards, there are cheaper options that make more sense in a budget build. The cheapest Z87 board available costs around $130 and this GA-B85M-D3H can be had for around $99. It doesn't have some higher-end features, but it's fine for basic gaming – it even carries support for AMD CrossFire dual-card gaming. In a single-card system, you'll be hard pressed to notice any difference between B85 and Z87 boards. The only major features missing here compared with Z87 boards are Intel's Rapid Storage Technology (RAID) and the ability to overclock the CPU. We need neither here.

AMD BUILD

PROCESSOR: AMD FX-8320

AMD's most recent FX-8320 Vishera-class CPU won't match Intel's Core i5-4430 in a single-threaded test, but with eight cores to play with it should still do well on games that support multithreading. It's about $20 cheaper than the Core i5-4430 and has overclocking support, although if you do that, you should factor in a better heatsink/fan combo.

MOTHERBOARD: ASUS M5A97 R2.0

To get the best out of that AMD chip, you should ideally hook it up to at least an AMD 970-chipset board. The M5A97 R2.0 has all the mod cons: SATA 6Gbps, USB 3.0 and like the GA-B85M-D3H, it's CrossFire ready. This board costs about $20 more than the Gigabyte, so all up, you're paying about the same for both CPU/motherboard combos.

GRAPHICS CARD: AMD RADEON HD 7850 OC

Once you get past the CPU and motherboard, there's plenty of mix and match between these two builds. Here, we've gone for AMD's Radeon HD 7850 OC, which you could use in either system. It's a smidgen faster than the GTX 660 and costs around the same. Personally, we'd lean towards the GTX 660 if you're thinking of building a Linux-based Steam box. Most reports back up our experience – Nvidia's Linux drivers (admittedly closed-source) are easier to play with than AMD's.

BOTH BUILDS

PSU: ANTEC HCG-520 520W ATX PSU

If you're wondering what on Earth a power supply is doing in the key component list, hold your horses. Without a PSU, your computer does nothing. And if it blows up, your computer

SUGGESTED BUDGET GAMING BUILDS

	INTEL	COST	AMD	COST
CPU	Intel Core i5-4430	$209	AMD FX-8320	$189
CPU cooler	Stock	$0	Stock	$0
Motherboard	Gigabyte GA-B85M-D3H	$99	ASUS M5A97 R2.0	$119
RAM	8GB DDR3-1600	$75	8GB DDR3-1600	$75
Graphics card	Nvidia GeForce GTX 660 2GB	$219	AMD Radeon HD 7850 OC 2GB	$219
Hard drive	1TB Western Digital WD10EZEX Blue	$69	1TB Western Digital WD10EZEX Blue	$69
Operating system	Microsoft Windows 8 (64-bit)	$99	Microsoft Windows 8 (64-bit)	$99
Case	Cooler Master Elite 342	$49	Cooler Master Elite 342	$49
PSU	Antec HCG-520	$89	Antec HCG-520	$89
	Total cost	$908		$908

MOTHERBOARD
Gigabyte's GA-B85M-D3H board is a decent budget option for gaming.
INTEL CPU
Intel's Core i5-4430 will handle any graphics card for the next year or two.
GRAPHICS CARD
Nvidia's GeForce GTX 660 gives good performance at around $200.
PSU
Antec's HCG-520 PSU is made by Seasonic and as good as you'll find for $89.
HDD
Western Digital's Blue WD10EZEX is faster than Green-class drives, but still cheap.
AMD CPU
The FX-8320 is arguably the best-value AMD performance chip at the moment.
GRAPHICS CARD
AMD's Radeon HD 7850 is a slighter faster option to the GTX 660.

probably does nothing forever more. So even if you're on a tight budget, it pays to ensure that you get a PSU with sufficient capacity for the job at hand and one that's reliable enough that it won't pop on you.

We've gone for Antec's 520W High Current Gamer (HCG-520) model. It's made for Antec by Seasonic, one of the best PSU builders in the business. It's based on Seasonic's S12 II chassis, so it's about as bullet-proof as you'll get for its $89 price tag.

Nvidia recommends a 450W PSU minimum to run a GeForce GTX 660 graphics card, so we're covering that base comfortably. Not only that, a GTX 660 Ti or a Radeon HD 7870 card still only needs 500W, so the HCG-520 is a PSU you'll want to hang onto for some time yet.

OTHER COMPONENTS

With those four components alone, we're using up two-thirds of our $900 budget and with another $100 still needed for Windows 8, you need to consider lower-cost options elsewhere. Obviously, the more you can salvage from a previous build (RAM, case, PSU, keyboard, mouse and so on), the more cash you can plough back into a faster graphics card.

If this is a new build, stick with 8GB of DDR3-1600 RAM – you won't need any more than that. You also don't have the luxury of a fancy case, although you'll be looking at your screen most of the time, not the PC case. Of course, an SSD to run the operating system would be great, but not on a $900 budget. Instead, we've chosen Western Digital's 1TB WD10EZEX Blue hard drive at around $70; however, for around $20 more, you could upgrade that to a faster 500GB Black-grade drive if you prefer.

FUTURE PRIORITIES

The important feature in both builds is there's no technical impediment to upgrading the graphics card to something more serious in the future. Both builds can happily handle the fastest single-GPU cards on offer. The limitation will be the PSU, which should be increased to a 650W unit.

Since both boards support CrossFire gaming, you could also choose a Radeon HD 7850 OC now and purchase a second one later for improved gaming speeds. Again, you'll need to increase the PSU capacity to around 800W to handle both cards safely.

An SSD would certainly be a tempting addition, too. We'd recommend a minimum 120GB drive as your system drive, although this would only improve system boot and game loading times, not necessarily improve gameplay speeds. The CPU and GPU combo still controls overall games speed, even with an SSD on board.

software

APPS FOR ALL THE PLATFORMS BY PETER DOCKRILL & MATTHEW J.C. POWELL

Windows 8 Store

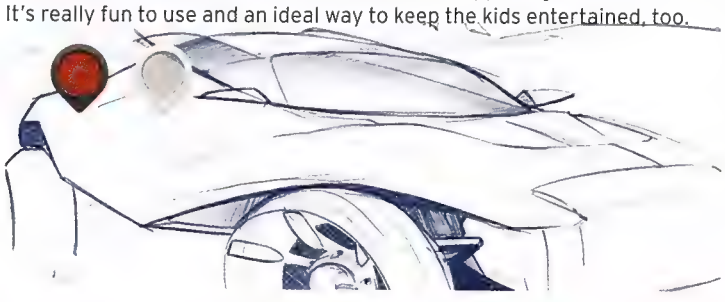
WINDOWS 8 APPS

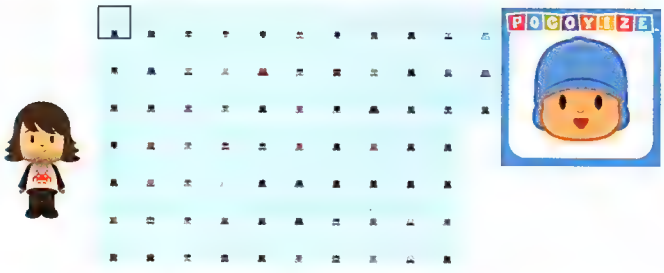
SketchBook Express

Unleash your inner artist.

Free | Autodesk | tinyurl.com/mx28x62

Digital art has experienced a surge in popularity recently, thanks largely to apps such as SketchBook Express – a sleek program that delivers powerful results. It's also touch-friendly, so you can get started with nothing more than your finger and a touch-enabled Windows 8 device. To the lower-right of the screen you'll find a menu of brushes and you can choose your colours using the icons to the upper-right of the screen. It's really fun to use and an ideal way to keep the kids entertained, too.





Pocoyize

Free | Zinkia Entertainment | tinyurl.com/kk4okc4

Pocoyo is a hugely popular Spanish kids' TV show, which is making the jump internationally complete with a new voiceover from Stephen Fry. A big part of its success is its bold, cartoony animation style and character design, and with Pocoyize you can create your own customised version of the eponymous character. The array of options you'll find is huge and you can choose from lots of different haircuts, clothing and accessories. Once you've created your character, you can save it as an image on your computer or even set it as your Microsoft account picture from within the app itself. It's a great way to refresh your account pictures on other social networks and kids can have a lot of fun creating Pocoyo versions of their friends and family.

FaceGoo

Free | Springy | tinyurl.com/m5jr9rr

Jazz up your profile pictures with this hilarious app, which can edit, distort and add accessories to any photo.

edjing

Free | DJiT | tinyurl.com/msesqms

Ever fancied becoming the next Fatboy Slim? edjing is a virtual set of turntables that lets you scratch, mix and tune your favourite MP3s to your heart's content – a must-have for any upcoming party.

SocialNV

Free | nventive | tinyurl.com/kjzzqu5

Social NV makes your Facebook feed far more Windows 8-friendly. It's all arranged vertically, so you can flick to new and interesting stories, and you can quickly post updates, too. Perfect for social network addicts.

VEVO

Free | VEVO | tinyurl.com/jwmv6k6

VEVO's app makes it easy to find artists or genres you like and there are MTV-style channels on the way.

Loupe

Free | David Anson | tinyurl.com/l84prh2

Loupe uses state-of-the-art rendering to display your pictures in their original glory and share them with your friends.

Men's Health Workouts

$2.99 | Rodale | tinyurl.com/koytewg

If *Man of Steel* has inspired you to get a body of iron, this app is a great place to start. It presents workouts with instructions and timers so you can really gets those muscles pumping.

Mac Store | APPS

Shadowgun: DeadZone

Free | Madfinger Games | tinyurl.com/sgdeadzone

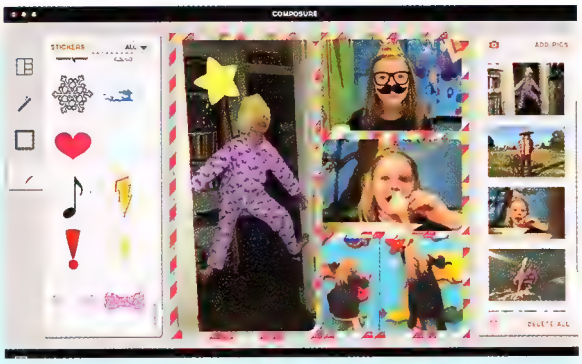
This isn't the sort of game that Gandhi would like you to play. You spawn, you run around, you find guns, you shoot people. They shoot you. Why? Who knows? It's violent and it's fun.

It's also free, which is a pretty good price for a game of this standard. As you might expect, the catch is in-app purchases, but they're surprisingly not too onerous. Basically, you can get better weapons and armour with gold coins, which you earn during gameplay. If you're impatient, you can buy extra coins (a buck gets you 700 coins). As with other IAP-funded games like *Real Racing 3*, it's certainly possible to progress through the game without spending any money at all, but you may find yourself disadvantaged compared to people who did.

As you'd expect, it's multiplayer and you can either get a bunch of friends together or jump into a random deathmatch – whatever mood takes you. Some users have reported bugs on some of the maps, but that wasn't our experience. The developers are most likely working to get it going as smoothly as possible.

Composure

Free | Stuckpixel, Inc. | tinyurl.com/composuremac



Composure is the kind of very simple photo manipulation tool that seems to crop up by the hundreds on iOS, but has been fairly unusual on the Mac for whatever reason. It's ironic because the Mac's superior processing power (not to mention file system) is pretty useful for this type of application.

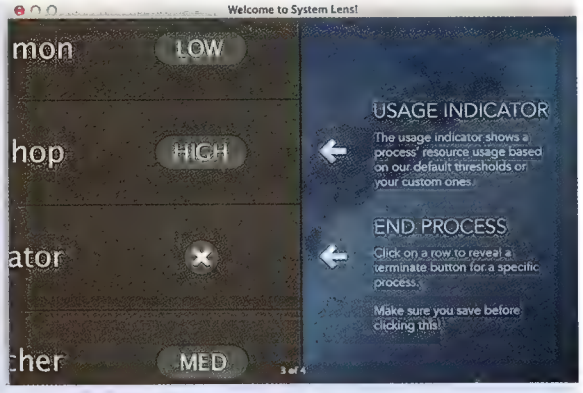
You start by grabbing a selection of photos you might like to assemble into a composition. You can use the Mac's file system or grab photos from Facebook or PhotoStream. Oddly enough, there doesn't appear to be a way to use your iPhoto Library directly and the PhotoStream integration is confusing. I found dragging some photos from iPhoto to a folder and then into Composure the easiest way to go.

Next, choose a layout, drag your photos in and arrange them, add a border and any special effects you might like, and then a variety of stickers for funning it up. Within a couple of minutes you have a neat, creative way to present your photos to share with family or print out.

At the price, it's hard to justify not getting it.

System Lens

Free | Aaron Ng | tinyurl.com/syslens


Welcome to System Lens!
mon
LOW
hop
HIGH
ator
her
MED
USAGE INDICATOR
The usage indicator shows a process' resource usage based on our default thresholds or your custom ones.
END PROCESS
Click on a row to reveal a terminate button for a specific process.
Make sure you save before clicking this!

Yet another in the line of simple free utilities that do one thing and do it well is System Lens. In fact, what it does it does so well, it's pretty much an essential, especially if you're the type of user who runs a whole bunch of applications at once (and who isn't?).

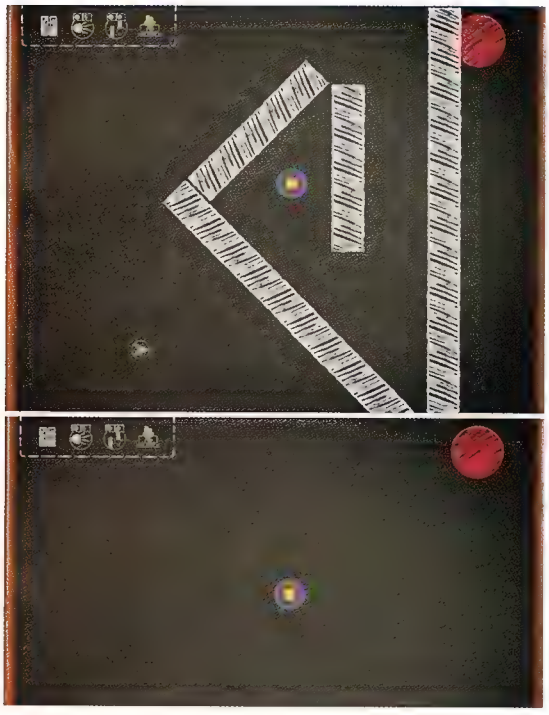
If you find your system slowing down or feeling a bit jerky or sluggish, it can be because of a process that's using more resources than it should. System Lens sits in your menu bar to keep tabs on what's using what at any time and warns you either with red bars or numbers indicating system usage. Click on the icon and you'll see the processes that are currently using significant system resources. If you see something that you don't actually need running taking up a lot, click the X to kill the process. It's that simple.

There's no need to stop what you're doing to run the Activity Monitor – everything's one click away.

As a handy side note, it's been really useful at demonstrating how much better OS X Mavericks is at putting background processes in the background than Mountain Lion was. It made it tricky to get a good screenshot, since hardly anything except what's in the foreground uses system resources anymore!

This is an absolute must-have for power users.

App Store | iOS APPS



The Impossible Line

Free (IAP) | Chillingo | tinyurl.com/impossibleline

Maze games aren't exactly a novelty on iOS – they've been on the App Store literally from day one and there are a lot of them. It's hard to see how a developer – even a clever developer like Chillingo – can differentiate their maze from the others.

Speaking of hard to see, how's this: the maze is invisible. You see the maze for a few seconds at the start of each level and then as soon as you start to draw, it vanishes. From there, you have to find your way to the target purely from memory. Nice.

There are power-ups, of course. You can have another three-second look at the maze if you want or you can use a 'miner's helmet' to illuminate just the part of the maze that's nearest you. The power-ups cost coins, and you earn these by completing levels or buying them. You can also pay money to remove the ads, which can be rather intrusive, albeit only between levels.

I'm not quite sure why the chalkboard background was necessary – it seems a bit of interface frippery that doesn't really add to the experience. Nonetheless, it's an engaging casual game to test your maze-solving skills, your dexterity and, of course, your memory.

Codea

$10.49 | Two Lives Left | tinyurl.com/CodeaOz

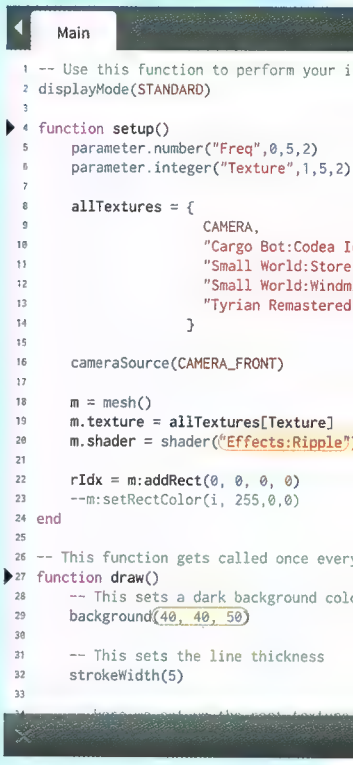
For all the success and praise that has been heaped upon Apple since the release of the iPad, one criticism has been persistent: the need to have a Mac and run Xcode to develop apps for it. While the restrictions have been loosened a little in recent times, it's still not been possible to achieve the holy grail: writing an iPad app on an iPad.

Codea changes that. It uses the Lua programming language, which is simple and fairly easy to learn. More interestingly, it makes use of the touch interface so that you can edit your code by touch: tap on a set of parameters and slide to change them, that kind of thing. If a particular bit of code refers to the colour of an object, you can change it by tapping on the code and a colour picker will pop up.

Don't worry if you've never programmed anything either. There's a wealth of tutorial and reference information included in the app, along with examples for you to muck around with. It's a whole lot easier than opening up Xcode and trying to figure out what to do next.

You can actually export fully-fledged App Store-ready apps straight from Codea, though of course, you'll have to be a registered developer before you can put them on the App Store.

If you've got a million-dollar idea, but no idea how to build an app, Codea's a place to start.



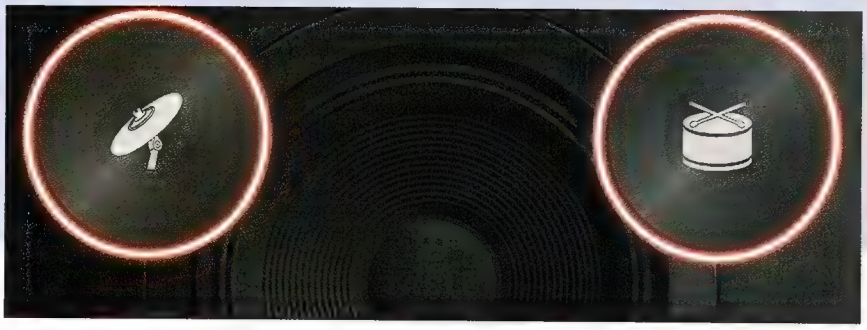
TableDrum

Free (IAP) | Dohi Sweden | tinyurl.com/TableDrum

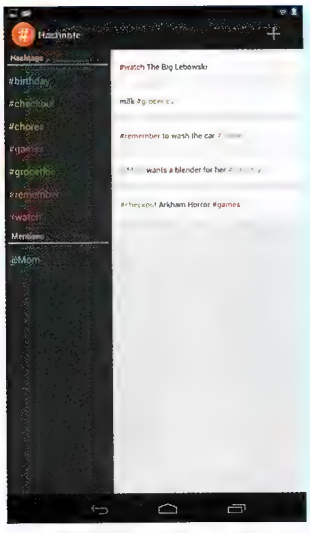
The inner drummer in all of us wants an app like this. You simply tap on your desk, your knees, your dinner plates and what comes out is the sound of a fully-fledged drum kit. Brilliant.

Or at least that's the idea. At first glance, TableDrum looks like any other drum app out there – tap on the onscreen drums and it makes drum noises. But its super power is the ability to link the onscreen icons to real-world triggers. Hold down the snare icon and whack the table, then the next time you whack the table it activates the snare. Great, right?

Except it doesn't really work. For one thing, you probably need Bluetooth speakers or something to make the iPad louder than whatever you're hitting. For another, it doesn't distinguish between triggers very well – whacking the table might trigger the crash as well as the snare. It's fun to play with, but needs work.



Google Play | ANDROID



Hashnote

Free/$2.16 | Ryan Harter | tinyurl.com/kdfeowz

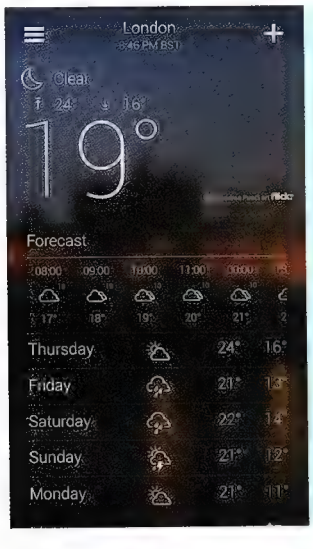
The email boom did great things for the @ character and now the # is undergoing a similar typographic revival due to the contemporary ubiquity of the hashtag. And with good reason: hashtags and keyword tagging generally are a powerful way to organise threads of content around a particular topic. Twitter's success with the hashtag has seen other social platforms jump to adopt the convention and Hashnote brings the same thinking to your personal note app. Need to remember to #buy the #groceries or send your @brother his #birthday card? The app lets you attach # and @ to whatever you want to keep track of, making it easy to recall tagged and common-tagged notes later. The latest version features rather jarring ads unfortunately, but at least it can be removed via in-app purchase. Also check out the web app (still in beta) at **hashnoteapp.com**.

Notes
Find more things for the kids to do this summer
Summer camp packing list
Get the miso ramen again. This is amazing
Schedule spa day for when kids are at camp
Saturday bike ride
Try zoo and redwoods this weekend
Weekend Garden work
Find the directions to

Google Keep

Free | Google | tinyurl.com/c9586s3

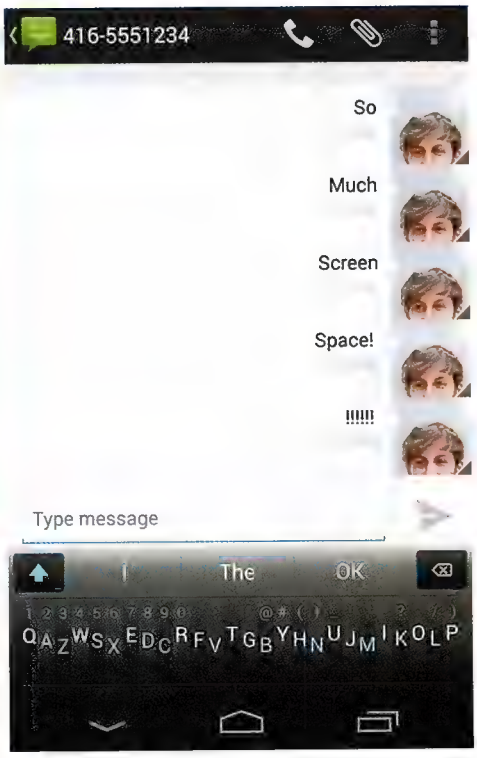
When Google launched Keep a little while back, it was easy to conclude the search giant was stepping onto Evernote's turf (ie. remember everything) with its take on the do-it-all memory chest. But unlike Evernote's broad approach, Google Keep is actually an extremely streamlined note-taking app for Android and web users. You can make simple text notes, write lists, capture photos, colour-code items and transcribe spoken audio on the fly. Notes sync effortlessly between the Android app and Google Drive web app, making it a handy option for keen Google users. Sweetening the deal further, Keep has just been updated with time- and location-based reminders, taking it one step closer to killer app status for casual productivity hounds. A small step away from the former minimalism, yep, but it only serves to make Keep more useful for the Google faithful.



Yahoo! Weather

Free | Yahoo! | tinyurl.com/k3c6aky

Normally when the internet and tech media collectively fall over themselves gushing about the latest 'beautiful' app, it's something exclusive to iOS – an operating system ethos that covets design as an end in itself (as evidenced by Apple's own best design awards for apps). But that doesn't mean beautiful things don't show up elsewhere and Yahoo!'s overhauled Weather app for Android is a neat example. Showcasing lush user-taken photography from Flickr in the background, Weather's slick interface gives you the current temperature and conditions at a glance, while swiping up from the bottom of the screen lets you delve into the forecast for the week, plus maps, barometric info and more. We'd give Yahoo! extra points if it added the gaze-drawing Ken Burns effect, too... but then we'd probably never stop checking the weather with this thing.



Minuum Keyboard

Rethinking QWERTY for mobile, one tap at a time.

$4.20 | Whirlscape | tinyurl.com/mw74agd

There are a number of alternative software keyboards available for use with Android, with some of the famous forerunners being Swype, SwiftKey and SlideIT, plus more recently Google's own well-implemented Google Keyboard. While each of these possesses their relative merits, it's fair to say there's a considerable degree of overlap between their features. Minuum Keyboard is a brand-new entrant into the field and it's taking the keyboard in a bold new direction: rather than offering another straight QWERTY facsimile, Minuum squeezes the conventional keyboard layout down into one long 26-character line and then uses software to help interpret your taps. It's certainly an interesting experiment, but might prove a bit of a steep learning curve for some users, essentially relearning QWERTY along one dimension. Still, lots of nifty options – plus a full keyboard feature – show Minuum's eager to meet you halfway.

Windows Store | WIN PHONE 8

Sleeve Music

Let your favourite artists come to you.

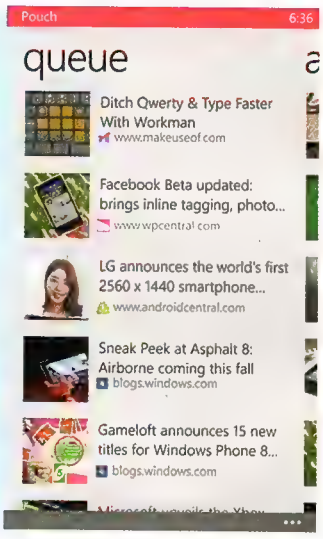
Free | Orange Tribes B.V. | tinyurl.com/kqrvbe7

Neatly referencing the love music fans had for the visual stimuli of LP record sleeves in a bygone musical era, Sleeve Music aims to be your one-stop shop for the latest news and updates on your favourite bands and performers. The app lets you follow artists you're interested in (either pulling them from your Facebook account or you can simply search within the app) to see their bios with extensive web links, YouTube updates, discography, photos and upcoming show lists. The best bit is the 'mix and match' page, which suggests other music you might be interested in based on the artists you already follow. It's not like Sleeve Music exactly reinvents the wheel with any of this functionality, but it's still a smoothly implemented WP8 experience and a great fix for music lovers.

Pouch

99c | Joshua Grzybowski | tinyurl.com/lp38y86

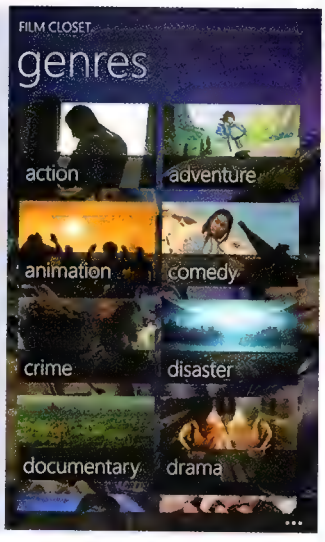
Read-it-later service Pocket is clearly on the up and up, with its name starting to be bandied about in the company of big-name productivity apps like Evernote. It's a part of Feedly's new Pro package, for example, which offers integration with both services (for a fee) for subscription users. So why hasn't this extremely useful app made its way to Windows Phone yet? Heaven knows, but in the meantime, as always, there's an unofficial client. The good news: Pouch, like its namesake, is a keeper. Simply log in with your Pocket ID and you'll find your reading queue there waiting for you, with all the standard Pocket features you'd expect to find. Our one gripe? Pouch can be a little laggy and unstable at times, but hopefully that gets fixed in the next update. If you're on the fence, try the free trial first.



Film Closet

Free | vaggelis diatsigkos | tinyurl.com/l8l4bcr

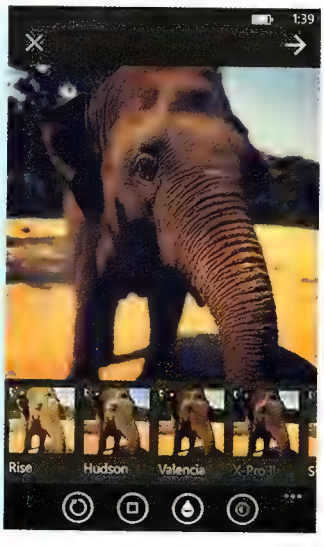
Movie lovers – and those simply stuck for something to watch – rejoice: Film Closet is bursting at the digital seams to give you the lowdown on all things celluloid. This nifty cinema app scours IMDB and rival The Movie Database (**themoviedb.org**) to serve up comprehensive film bios for what's currently playing in the cinemas (US cinemas, that is), upcoming releases, top-rated films and popular movies. You can watch trailers, see cast and crew listings, check out high-res movie posters and also discover new titles by searching through genres and filtering by year. If you're feeling adventurous, you can just hit the 'Shuffle' button and Film Closet will suggest something at random – with 100,000 titles in its database, don't be surprised if it's something you've never heard of. There are no built-in session times, but you'll find plenty of other apps for that.



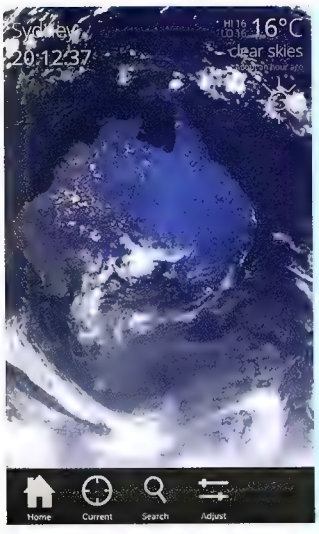
6tag

Free | Rudy Huyn | tinyurl.com/mcygrtt

Instagram is one of the fastest-growing social platforms of the moment, so it's no surprise WP8 users are clamouring to get their hands on it, yet Facebook continues to dawdle in bringing an official version. Just last month we covered Hipstamatic Oggl, one of a number of third-party Instagram clients for Windows Phone, albeit one with substantial caveats, including no photo feed. If those caveats proved a deal-breaker for you, check out the new kid on the block, 6tag. It's significantly more full-featured, with full support for Instagram's photo feed plus uploads (photo and even video). It's presented in a slick, 'Metro-ised' package, too, with some nice touches Instagram itself doesn't even have, like swiping sideways to bring up additional image features (including save to gallery). There's pretty much no need for an official client now. Nice one, 6tag.



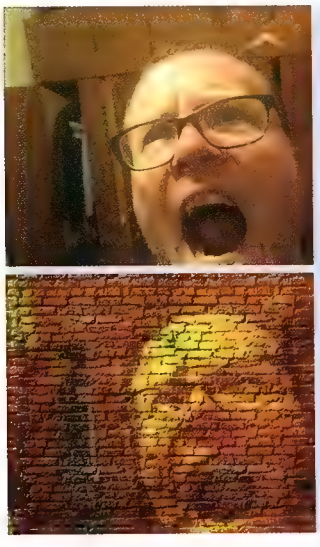
App World | BLACKBERRY



Orbit

$2.99 | Innovatology | tinyurl.com/orxoah2

If you've ever wanted to hold the whole world in the palm of your hand, Orbit might just be able to help you out. This hybrid weather and geography app is part toy and part scientific tool, but mostly it's an enjoyable curiosity. Orbit shows you a virtual real-time view of the world as it looks now, with satellite imagery from NASA and NOAA being used to wrap current cloud cover over a 3D Earth. It's kind of like an extremely dumbed-down Google Earth, as the zoom never lets you get in very close (we guess that's why it's called Orbit). However, with detailed weather conditions and local time provided for more than 1,700 locations around the world, the app has a fair degree of utility, too – we're just not sure if it's worth $3 for regular Earthbound types.



Effetica

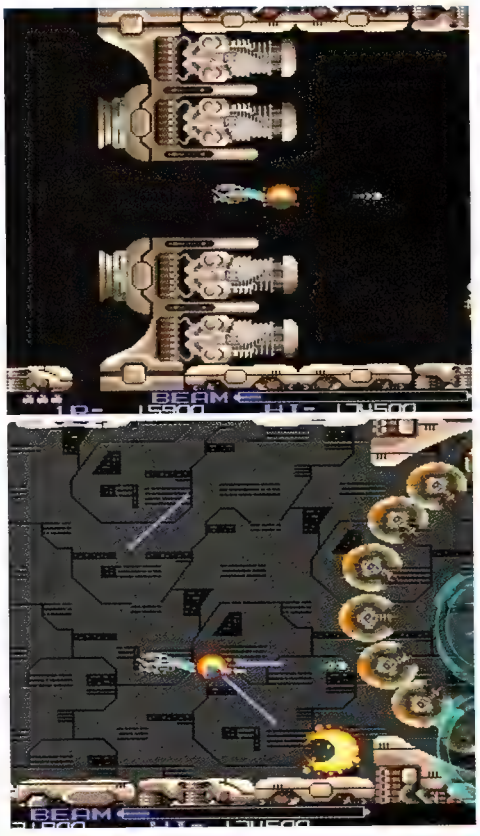
$4.49 | I&N MobiSoft | tinyurl.com/pljpycy

There's no shortage of photo editing apps in the world. In fact, at the rate they're currently expanding, photo editing apps will probably seize control of the planet sometime in the next few years with a Skynet-style takeover. But don't let that worry you; in the meantime, you should definitely check out Effetica. This powerful image editor features a huge raft of tools including rotate, crop, sharpness, blur, plus the ubiquitous tilt-shift. You can play with levels, brightness and saturation, and also create some interesting effects with filters, overlay, frames and more. Effetica doesn't really possess any standalone functions we haven't seen before in other apps, but its comprehensive feature set is impressive and well implemented. Try out the free demo version first, which is fully functional, but limits the resolution of your saved images.

BeMaps 10 Pro

$4.49 | Bellshare | tinyurl.com/qyszzol

BlackBerry 10 might ship with its own dedicated Maps app, but enquiring BlackBerry users can also opt for BeMaps 10 Pro, which offers the breadth and familiarity of Google Maps' data for under a fiver and only has a slightly hideous name. While it might not be as smooth as the search giant's home-baked efforts (and frankly it's a little crash-prone at times), BeMaps still includes all the functionality most users will need: address search, directions by various modes of transport (like vehicle, foot, bus or train), terrain layers (satellite, traffic, transit and so on) and more. And of course, because it's Google Maps, you're also granted access to the incomparable Street View, which alone will justify the financial outlay for some. This is a handy supplement for when BB's built-in Maps don't cut it.

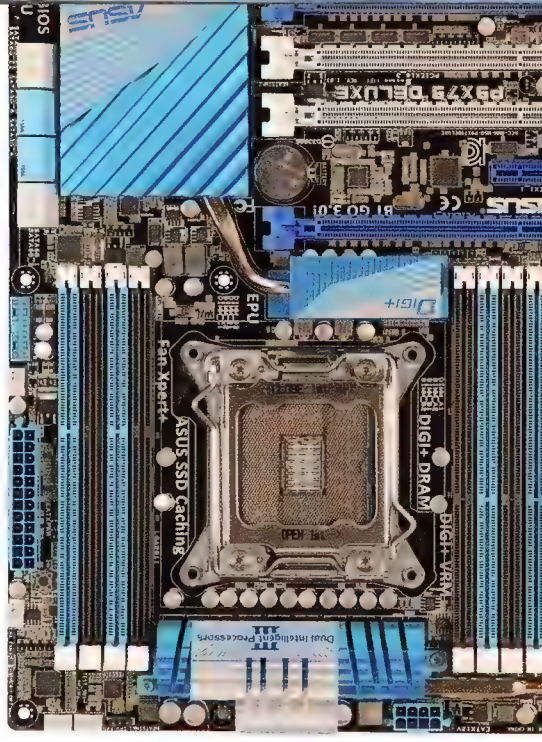


R-Type

It seems the Bydo Empire is still causing a ruckus.

$1.99 | DotEmu | tinyurl.com/pxbj9nh

It doesn't get much more retro than this. Seminal sideways arcade shooter *R-Type* has blasted out of '80s arcades and onto BlackBerry World via DotEmu's well-regarded and well-traversed port, which has now graced several platforms. If you ever played *R-Type* back in the day, DotEmu's version is an extremely faithful conversion, which is one way of saying that the game is hard. *Really hard.* In fact, it's this writer's secret shame that he's never managed to get past the fourth level. Sad, I know. But as great as *R-Type* on mobile is, combining the game's historical difficulty level with touchscreens is a recipe for more-than-occasional frustration, as you'll die often simply due to the so-so-ish ability to control your fighter. Still, for a nostalgic slice of coin-op nirvana, *R-Type* delivers in spades. Take that, Bydo Empire.



PUT IT TO THE TEST

With our lab coats donned, our test benches primed and our benchmarks at the ready, we look for answers to nine of the most burning performance-related questions.

If there's one thing that defines the *APC* ethos, it's an obsession with Labs testing. What better way to discern a product's performance capabilities, or judge the value of an upgrade, or simply settle a heated office debate? This month, we focus our obsession on several of the major questions on the minds of enthusiasts. Is liquid cooling always more effective than air? Should serious gamers demand PCIe 3.0? When it comes to RAM, are higher clocks better? On the surface, the answers might seem obvious. However, as far as we're concerned, nothing is for certain until it's put to the test. We're talking tests that isolate a subsystem and measure results using real-world workloads. Indeed, we not only want to know if a particular technology or piece of hardware is truly superior, but also by how much. After all, we're spending our hard-earned money on this gear, so we want our purchases to make real-world sense. Over the next several pages, we put some of the most pressing PC-related questions to the test. If you're ready for the answers, read on.

AMD's FX-8350 has two cores up on the competition, but does that matter?

Intel's Haswell Core i5-4670K slots right into the high end of the mid-range.

Core i5-4670K vs. Core i5-3570K vs. FX-8350

People like to read about the $1,000 high-end parts, but the vast majority of enthusiasts don't buy at that price range. In fact, they don't even buy the $350 chips. No, the sweet spot for many budget enthusiasts is around $270. To find out which chip is the fastest mid-range part, we ran Intel's new Haswell Core i5-4670K against the current champ, the i5-3570K, as well as AMD's Vishera FX-8350.

THE TEST: For our test, we socketed the Core i5-4670K into an ASUS Z87 Deluxe with 16GB of DDR3-1600 RAM, an OCZ Vertex 3, a GeForce GTX 580 card and Windows 8. For the Core i5-3570K, we used the same hardware in an ASUS P8Z77-V Premium board, while the FX-8350 was tested in an ASUS CrossHair V Formula board. We ran a whole set of benchmarks, which you'll find listed in the results table at the bottom of this page.

THE RESULTS: First, the most important factor in the budget category is the price. As we wrote this, the street price of the Core i5-4670K was $280, the older Core i5-3570K was in the $265 range and AMD's FX-8350 went for $240. The i5-4670K is definitely on the outer edge of the budget sweet spot, while the AMD is a bit cheaper.

One thing that's not disputable is the performance edge the new Haswell i5 part has. It stepped away from its Ivy Bridge sibling in every test we ran by respectable double-digit margins. And while the FX-8350 actually pulled close enough to the Core i5-3570K in enough tests to go home with some multithreaded victories in its pocket, it was definitely kept humble by Haswell. The Core i5-4670K plain and simply trashed the FX-8350 in the vast majority of the tests that can't push all eight cores of the FX-8350. Even worse, in the multithreaded tests where the FX-8350 squeezed past the Ivy Bridge Core i5-3570K, Haswell either handily beat or tied the chip with twice its cores.

Even folks concerned with bang-for-buck value will find the Core i5-4670K makes a compelling argument. Yes, it's 17% more expensive than the FX-8350, but in some of our benchmarks, it was easily that much faster or more. In Stitch.Efx 2.0, for example, the Haswell was 80% faster than the Vishera. Ouch.

So where does this leave us? For first place, we're proclaiming the Intel Core i5-4570K the mid-range king by a margin wider than the Grand Canyon.

For second place, however, we're going to get all controversial and call it for the FX-8350, albeit only by a narrow margin. Here's why: AMD's FX-8350 actually holds up against the Core i5-3570K in a lot of benchmarks, has an edge in mulitithreaded apps and its AM3+ socket has a far longer roadmap than LGA1155, which is currently on the fast track to Palookaville.

Granted, Ivy Bridge and LGA1155 is still a great option, especially when bought on a discounted combo deal, but it's a dead man walking and our general guidance for those who like to upgrade is to stick to sockets that still have a pulse. Let's not even mention that LGA1155 is the only one here with a pathetic two SATA 6Gbps ports. Don't agree? Great, because we have an LGA1156 motherboard and CPU to sell you.

The Core i5-3570K was great in its day, but it needs more than that to stay on top.

	CORE I5-4670K	CORE I5-3570K	AMD FX-8350
POV Ray 3.7 RC3 (sec)	168.53	227.75	184.8
Cinebench 10 Single-Core	8,500	6,866	4,483
Cinebench 11.5	6.95	6.41	6.9
7Zip 9.20	17,898	17,504	23,728
Fritz Chess	13,305	11,468	12,506
Premiere Pro CS6 (sec)	2,849	3,422	5,220
HandBrake Blu-ray encode (sec)	9,042	9,539	8,400
x264 5.01 Pass 1 (fps)	66.3	57.1	61.3
x264 5.01 Pass 2 (fps)	15.8	12.7	15
Sandra (GB/s)	21.6	21.3	18.9
Stitch.Efx 2.0 (sec)	836	971	1,511
ProShow Producer 5 (sec)	1,275	1,463	1,695
STALKER: CoP low-res (fps)	173.5	167.3	132.1
3DMark 11 Physics	7,938	7,263	7,005
PC Mark 7 Overall	6,428	5,582	4,408
PC Mark 7 Storage	5,300	5,377	4,559
Valve Particle (fps)	180	155	119
Heaven 3.0 low-res (fps)	139.4	138.3	134.4

Hyper-Threading vs. no Hyper-Threading

Hyper-Threading came out 13 years ago with the original 3.06GHz Pentium 4 and was mostly a dud. Few apps were multithreaded and even Windows' own scheduler didn't know how to deal with it, making some apps actually slow down when the feature was enabled. But the tech overcame those early hurdles to grow into a worthwhile feature today. Builders are continually faced with choosing between processors with and without HT, so we wanted to know definitively how much it matters.

THE TEST: Since we haven't actually run numbers on HT in some time, we broke out a Core i7-4770K and ran tests with HT turned on and off. We used a variety of benchmarks with differing degrees of threadedness to test the technology's strengths and weaknesses.

THE RESULTS: One look at our results and you can tell HT is well worth it if your applications can use the available threads. We saw benefits of 10-30% from HT in some apps. However, if your app can't use the threads, you gain nothing. In rare instances, it appears to hurt performance slightly – as in *Hitman: Absolution*, when run to stress the CPU rather than the GPU. Our verdict is that you should pay for HT, but only if your chores include 3D modelling, video encoding or transcoding, or other thread-heavy tasks. Gamers who occasionally transcode videos, for example, would get more bang for their buck from a Core i5-4670K.

BENCHMARKING: SYNTHETIC VS. REAL WORLD

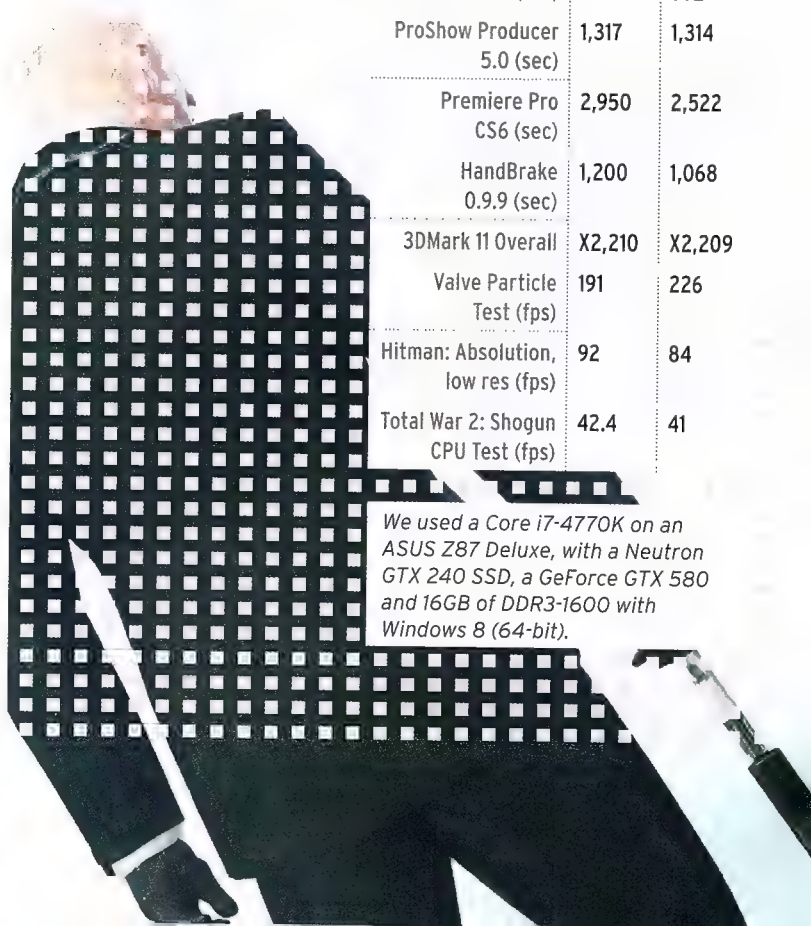
There's a tendency for testers to dismiss 'synthetic' benchmarks as having no value whatsoever, but that attitude is misplaced. Synthetics got their bad name in the 1990s, when they were the only game in town for testing hardware. Hardware makers soon started to optimise for them and on occasion, those actions would actually hurt performance in real games and applications.

The 1990s are long behind us, though, and benchmarks and the benchmarking community have matured to the point that synthetics can offer very useful metrics when measuring the performance of a single component or system. At the same time, real-world benchmarks aren't untouchable. If a developer receives funding or engineering support from a hardware maker to optimise a game or app, does that really make it neutral? There's the argument that it doesn't matter because if there's 'cheating' to improve performance, that only benefits the users. Except that it only benefits those using a certain piece of hardware.

In the end, it's probably more important to understand the nuances of each benchmark and how to apply them when testing hardware. SiSoft Sandra, for example, is a popular synthetic benchmark with a slew of tests for various components. We use it for memory bandwidth testing, for which it' s invaluable – as long as the results are put in the right context. A doubling of main system memory bandwidth, for instance, doesn't mean you get a doubling of performance in games and apps. Of course, the same caveats apply to real-world benchmarks, too.

	HT OFF	HT ON
PCMark 7 Overall	6,308	6,348
Cinebench 11.5	6.95	8.88
Stitch.EFx 2.0 (sec)	772	772
ProShow Producer 5.0 (sec)	1,317	1,314
Premiere Pro CS6 (sec)	2,950	2,522
HandBrake 0.9.9 (sec)	1,200	1,068
3DMark 11 Overall	X2,210	X2,209
Valve Particle Test (fps)	191	226
Hitman: Absolution, low res (fps)	92	84
Total War 2: Shogun CPU Test (fps)	42.4	41

We used a Core i7-4770K on an ASUS Z87 Deluxe, with a Neutron GTX 240 SSD, a GeForce GTX 580 and 16GB of DDR3-1600 with Windows 8 (64-bit).



It may not look like much, but the Kraken X60 is the Ferrari of closed-loop coolers.

Air cooling vs. water cooling

There are two main ways to chill your CPU: a heatsink with a fan on it or a closed-loop liquid cooler (CLC). Unlike a custom loop, you don't need to periodically drain and flush the system or check it for leaks. The 'closed' part means it's sealed and integrated. This integration also reduces manufacturing costs and makes the setup much easier to install. If you want maximum overclocks, custom loops are the best way to go, although it's a steep climb in cost for a modest improvement beyond what current closed loops can deliver.

However, air coolers aren't down for the count. They're still the easiest to install and the cheapest. The prices between air and water are so close now that it's worth taking a look at the field to determine what's best for your budget.

THE TEST: To test the two cooling methods, we dropped them into a rig with a hex-core Intel Core i7-3960X overclocked to 4.25GHz on an Asus Rampage IV Extreme motherboard, inside a Corsair 900D. By design, it's kind of a beast and tough to keep cool.

THE BUDGET CLASS

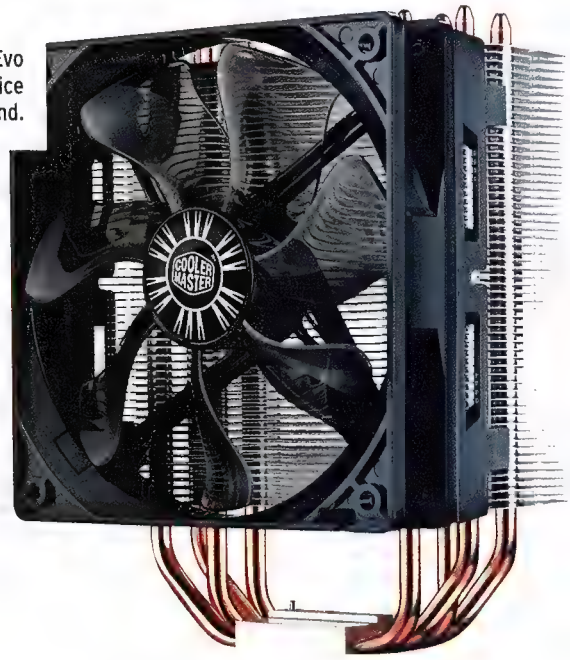
THE RESULTS: At this level, the Cooler Master 212 Evo is legendary. It runs cool and quiet, it's easy to pop in, it can adapt to a variety of sockets, it's durable and it costs about $40. Despite the i7-3960X's heavy load, the 212 Evo averages about 70°C across all six cores, with a room temperature of about 22°C. Things don't tend to get iffy until 80°C, which means there's room to go even higher. Not bad for a cooler with one 120mm fan on it.

Entry-level water coolers cost substantially more, unless you're patient enough to wait for a fire sale. They require more materials, more manufacturing and more complex engineering. The Cooler Master Seidon 120M is a good example of the kind of unit you'll find at this tier. It uses a standard 120mm fan attached to a standard 120mm radiator and currently has a street price of $80. In our tests, its thermal performance was about the same, or worse, than the 212 Evo. In order to meet an aggressive price target, you have to make some compromises. The pump is smaller than average, for example, and the copper block you install on top of the CPU isn't as thick. The Seidon was moderately quieter, although we have to give the nod to the 212 Evo when it comes to raw performance.

THE PERFORMANCE CLASS

THE RESULTS: While a CLC has trouble scaling its manufacturing costs down to the budget level, there's a lot more headroom when you hit the $150 mark. The NZXT Kraken X60 CLC is one of the best examples in this class. Its dual-140mm fans and 280mm radiator can unload piles of heat without generating too much noise, and it has a larger pump and apparently larger tubes than the Seidon 120M. Our tests bear out the promise of the X60's design, with its 'quiet' setting delivering a relatively chilly 66°C, or about 45° above the ambient room temp.

Is there any air cooler that can keep up? Well, we grabbed a Phanteks TC14PE, which uses two heatsinks instead of one, dual-140mm fans and retails for $130. It performed only a little cooler than the 212 Evo, but it did so very quietly, like a ninja. At its quiet setting, it trailed behind the X60 by 5°C. It may not sound like much, but that extra 5°C of headroom means a higher potential overclock. So, water wins the high end.



The Cooler Master 212 Evo has arguably the best price to performance ratio around.

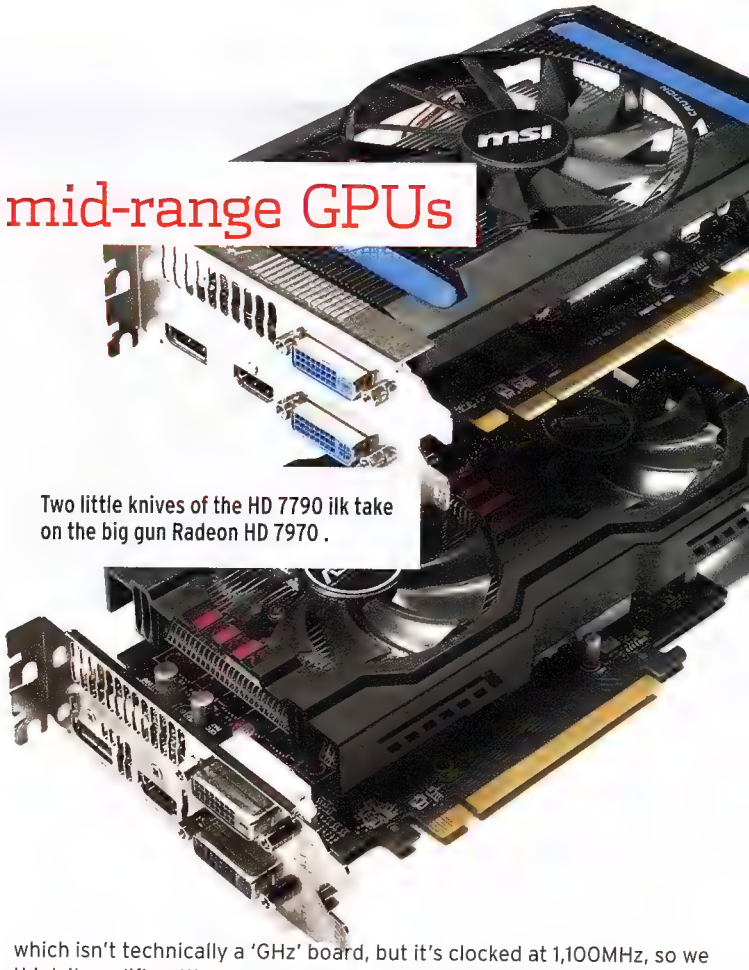
	SEIDON 120M QUIET/ PERF MODE	212 EVO QUIET/PERF MODE	KRAKEN X60 QUIET/ PERF MODE	TC14PE QUIET/PERF MODE
Ambient air	22.1/22.2	20.5/20	20.9/20.7	20/19.9
Idle temperature	38/30.7	35.5/30.5	29.7/28.8	32/28.5
Load temperature	78.3/70.8	70/67.3	66/61.8	70.3/68.6
Load – ambient	56.2/48.6	49.5/47.3	45.1/41.1	50.3/48.7

All temperatures in degrees Celsius.

One high-end GPU vs. two mid-range GPUs

One of the most common questions we get here at *APC* is whether to upgrade to a high-end GPU or run two less-expensive cards in either SLI or CrossFire mode. It's a good question, since high-end GPUs are expensive and cards that are two rungs below them in the product stack cost about half the price, which naturally begs the question: Are two $330 cards faster than a single $800 card?

Before we jump to the tests, dual-card setups suffer from a unique set of issues that need to be considered. First is the frame pacing situation, where the cards are unable to deliver frames evenly, so even though the overall frames per second (fps) rating is high, there's still micro-stutter on the screen. Nvidia and AMD dual-GPU configs suffer from this, although Nvidia's SLI has less of a problem than AMD at this time. Both companies also need to offer drivers to allow games and benchmarks to see both GPUs, but they're equally good at delivering drivers the day games are released, so the days of waiting two weeks for a driver are largely over.



Two little knives of the HD 7790 ilk take on the big gun Radeon HD 7970 .

2X NVIDIA GTX 660 TI VS. GTX 780

THE TEST: We considered using two $320 GTX 760 GPUs for this test, but Nvidia doesn't have a $600 GPU to test them against and since this is *APC*, we rounded up one model from the 'mainstream' to the $330 GTX 660 Ti. This video card was recently replaced by the GTX 760, causing its price to drop down a bit. We got two of them to go up against the GeForce GTX 780, which costs $790, so it's not a totally fair fight, but we figured it's close enough for government work. We ran our standard graphics test suite in both single- and dual-card configurations.

THE RESULTS: It looks like our test was conclusive: two cards in SLI mode provide a slightly better gaming experience than a single badass card, taking top marks in seven out of nine tests. And they cost less to boot. Nvidia's frame pacing was virtually without issues, too, so we don't have any problem recommending Nvidia SLI at this time. It's the superior cost/performance setup as our benchmarks show.

2X RADEON HD 7790 VS. RADEON HD 7970 GHZ

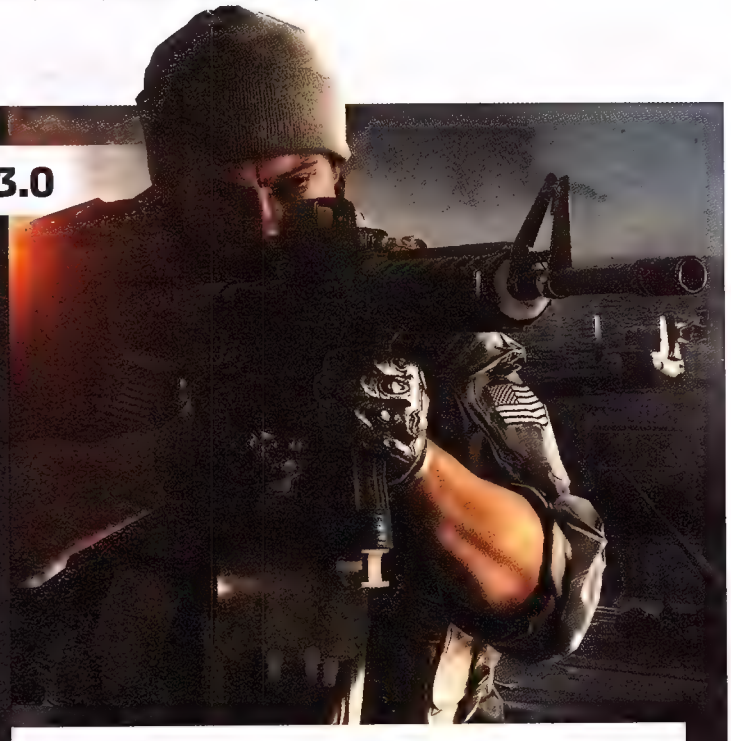
THE TEST: For our AMD comparison, we took two of the recently released HD 7790 cards at $180 each and threw them into the octagon with a $400 GPU, the PowerColor AX7990 Radeon HD 7970 Vortex II, which isn't technically a 'GHz' board, but it's clocked at 1,100MHz, so we think it qualifies. We ran our standard graphics test suite in both single and dual-card configurations.

THE RESULTS: Our AMD tests resulted in a very close battle, with the dual-card setup taking the win by racking up higher scores in six out of nine tests, and the single HD 7970 card taking top spot in the other three tests. But what you can't see here is that the dual HD 7790 cards were totally silent while the HD 7970 card was loud as hell. Also, AMD has acknowledged the micro-stutter problem with CrossFire, and promises a software fix for it, but unfortunately, that fix was going to arrive right as we are going to press. Even without it, gameplay seemed smooth and the duo is clearly faster, so it gets our vote as the superior solution, at least in this configuration.

Nvidia's new GK110-based GTX 780 takes on two ankle-biter GTX 660 Ti GPUs.

	NVIDIA GEFORCE GTX 660 TI SLI	NVIDIA GEFORCE GTX 780	AMD RADEON HD 7870 CROSSFIRE	AMD RADEON HD 7970 GHZ
3DMark Fire Strike	8,858	8,482	8,842	7,329
Catzilla (Tiger) Beta	7,682	6,933	6,184	4,889
Unigine Heaven 4.0 (fps)	33	35	30	24
Crysis 3 (fps)	26	24	15	17
Shogun 2 (fps)	60	48	51	43
Far Cry 3 (fps)	41	35	21	33
Metro: Last Light (fps)	24	22	13	14
Tomb Raider (fps)	18	25	24	20
Battlefield 3 (fps)	56	53	57	41

Our test bed is a 3.33GHz Core i7-3960X Extreme Edition in an ASUS P9X79 motherboard with 16GB of DDR3-1600 and a Thermaltake ToughPower 1,050W PSU. The OS is 64-bit Windows 7 Ultimate. All tests, except for the 3DMark tests, are run at 2,560 x 1,600 with 4x antialiasing.

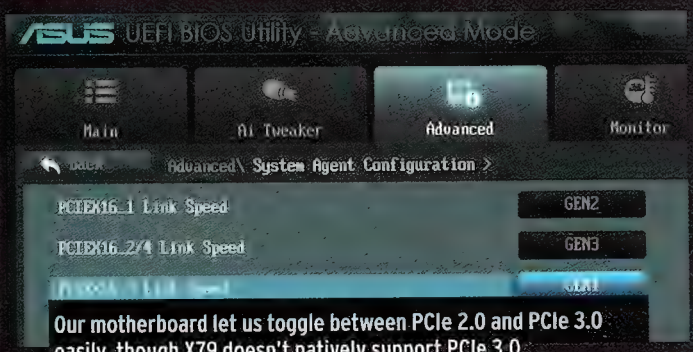


PCI EXPRESS 2.0 VS. PCI EXPRESS 3.0

PCI Express (PCIe) is the specification that governs the amount of bandwidth available between the CPU and the PCIe slots on your motherboard. We've recently made the jump from version 2.0 to version 3.0 and the PCIe interface on all late-model video cards is now PCIe 3.0, causing many frame rate addicts to question the sanity of placing a PCIe 3.0 GPU into a PCIe 2.0 slot on their motherboard. The reason why is that PCIe 3.0 has quite a bit more theoretical bandwidth than PCIe 2.0. Specifically, one PCIe 2.0 lane can transmit 500MB/s in one direction, while a PCIe 3.0 lane can pump up to 985MB/s, so it's almost double the bandwidth. Then multiply that by 16, since there are that many lanes being used, and the difference is substantial. However, that extra bandwidth will only be important if it's even needed, which is what we wanted to find out.

THE TEST: We plugged an Nvidia GTX Titan into our ASUS P9X79 board and ran several of our gaming tests with the top PCIe x16 slot alternately set to PCIe 3.0 and PCIe 2.0. On this particular board you can switch the setting in the BIOS.

THE RESULTS: We had heard previously that there was very little difference between PCIe 2.0 and PCIe 3.0 on current systems and our tests back that up. In every single test, Gen 3.0 was faster, but the difference is so small it's very hard for us to believe that PCIe 2.0 is being saturated by our GPU. It's also quite possible that one would see more pronounced results using two or more cards, although we wanted to keep it real and just use one card.



Our motherboard let us toggle between PCIe 2.0 and PCIe 3.0 easily, though X79 doesn't natively support PCIe 3.0.

	GTX TITAN PCIE 2.0	GTX TITAN PCIE 3.0
3DMark Fire Strike	9,363	9,892
Unigine Heaven 4.0 (fps)	37	40
Crysis 3 (fps)	31	32
Shogun 2 (fps)	60	63
Far Cry 3 (fps)	38	42
Metro: Last Light (fps)	22	25
Tomb Raider (fps)	22	25

Our test bed is a 3.33GHz Core i7 3960X Extreme Edition in an ASUS P9X79 motherboard with 16GB of DDR3-1600 and a Thermaltake ToughPower 1,050W PSU. The OS is 64-bit Windows 7 Ultimate. All games are run at 2,560 x 1,600 with 4x antialiasing except for the 3DMark tests.

SSD RAID vs. single SSD

This test is somewhat analogous to the GPU comparison, as most people would assume that two small-capacity SSDs in RAID 0 would be able to outperform a single 256GB SSD. The little SSDs have a performance penalty out of the gate, though, as SSD performance usually improves as capacity increases, since the controller is able to grab more data, given the higher-capacity NAND wafers – just like higher-density platters increase hard drive performance. This isn't a universal truth, however, and whether performance scales with an SSD's capacity depends on the drive's firmware, NAND flash and other factors. In general, it's true that the higher the capacity of a drive, the better its performance. The question then is: is the performance advantage of the single large drive enough to outpace two little drives in RAID 0?

Before we jump into the numbers, we have to say a few things about SSD RAID. The first is that with the advent of SSDs, RAID setups aren't quite as common as they were in the HDD days. The main reason is it's really not that necessary since a standalone SSD is already extremely fast. Adding more speed to an already fast equation isn't a big priority for a lot of home users. Even more importantly, the biggest single issue with SSD RAID is that the operating system is unable to pass the TRIM command to the RAID controller in most configurations (Intel 7- and 8-series chipsets excluded), so the OS can't tell the drive how to keep itself optimised, which can degrade the performance of the array in the long run, making the entire operation pointless. It's true that the drive's controller will perform routine garbage collection, but how that differs from TRIM is uncertain and whether it's able to manage the drive equally well is also unknown. However, the lack of TRIM support on RAID 0 is a scary thing for a lot of people, so it's one of the reasons SSD RAID often gets avoided. Personally, we've never seen it cause any problems, so we're fine with it. We even ran it in our Dream Machine 2013 and it rocked the Labs. So, even though people will say SSD RAID is bad because there's no TRIM support, we've never been able to verify exactly what that 'bad' means in the long term.

THE TEST: We plugged in two Corsair Neutron SSDs, set the SATA controller to RAID, created our array with a 64KB stripe size and then ran all of our tests off an Intel 520 SSD boot drive. We used the same protocol for the single drive.

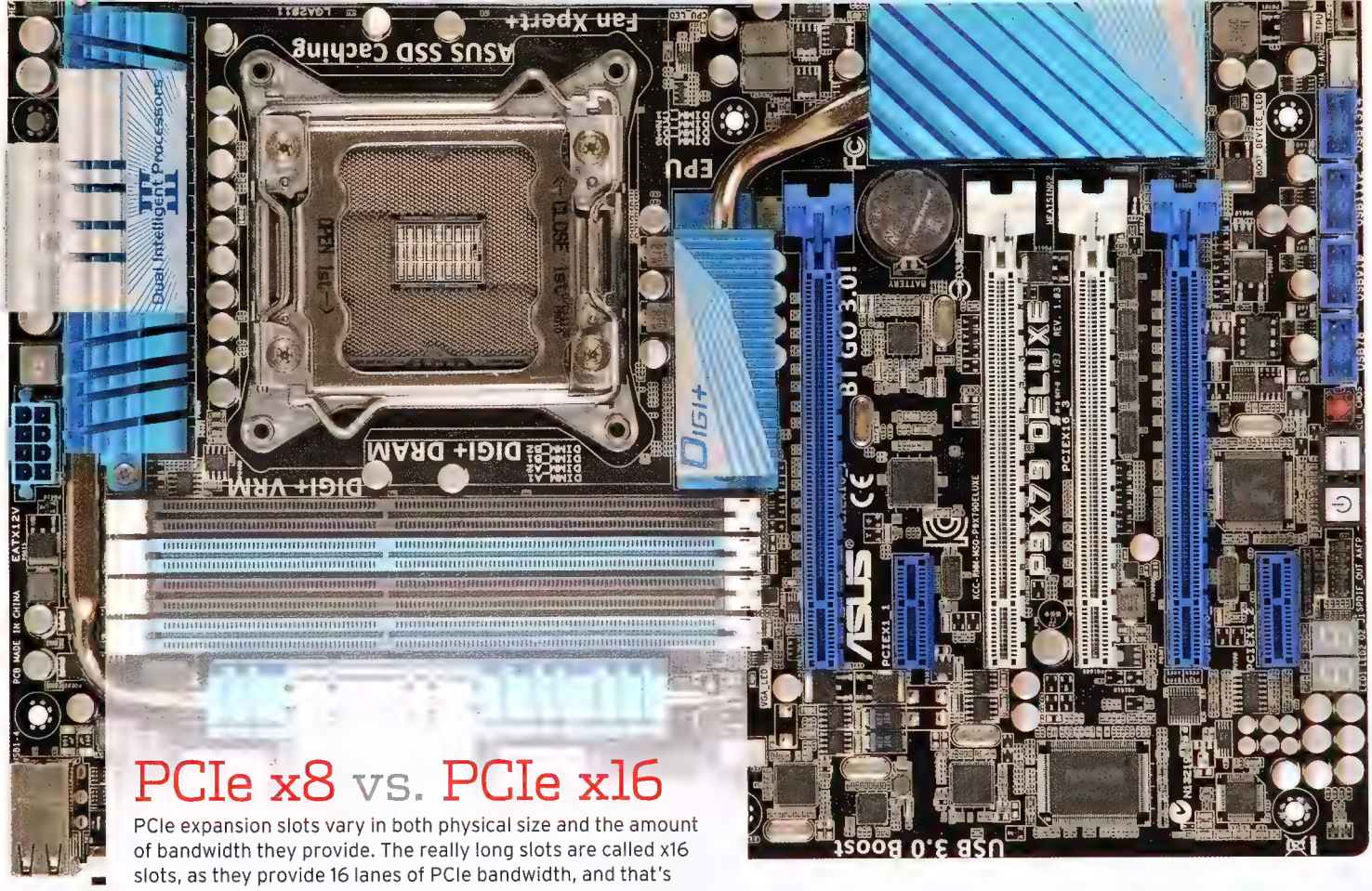
THE RESULTS: The results of this test show a pretty clear advantage for the RAIDed SSDs, as they were faster in seven out of nine tests. That's not surprising, however, as RAID 0 has always been able to benchmark well. That said, the single 256 Corsair Neutron drive came damned close to the RAID in several tests, including CrystalDiskMark, ATTO at four queue depth and AS SSD. It's not a completely an open-and-shut case, though, because the RAID scored poorly in the PC Mark Vantage real-world benchmark, with just one-third of the score of the single drive. That's cause for concern, but with these scripted tests it can be tough to tell exactly where things went wrong, since they just run and then spit out a score. Also, the big advantage of RAID is that it boosts sequential read and write speeds since you have two drives working in parallel (conversely, you typically won't see a big boost for the small random writes made by the OS). Yet the SSDs in RAID were actually slower than the single SSD in our Sony Vegas real-world 20GB file encode test, which is where they should have had a sizable advantage. For now, we'll say this much: the RAID numbers look good, but more real-world investigation is required before we can tell you one is better than the other.

	1X CORSAIR NEUTRON 256GB	2X CORSAIR NEUTRON 128GB RAID 0
CrystalDiskMark		
Avg. sustained read (MB/s)	512	593
Avg. sustained write (MB/s)	436	487
AS SSD – compressed data		
Avg. sustained read (MB/s)	506	647
Avg. sustained write (MB/s)	318	368
ATTO		
64KB file read (MB/s, 4QD)	436	934
64KB file write (MB/s, 4QD)	516	501
Iometer		
4KB random write 32QD (IOPS)	70,083	88,341
Sony Vegas Pro 9 Write (sec)	343	429

All tests conducted on our hard drive test bench, which consists of a Gigabyte Z77X-UP4 motherboard, Intel Core i5-3470 3.2GHz CPU, 8GB of RAM, Intel 520 Series SSD and a Cooler Master 450W power supply.

INTEL & AMD ON TRIMMING YOUR RAID

If you'd love to run SSD RAID, but don't because you've heard that the controllers don't support the TRIM command, you were right in early 2012, although times have changed. Today, Intel supports passing TRIM through RAID, but in order to do so you need the following: Intel's Rapid Storage Technology (iRST) software version 11 or later, two SSDs that are already in RAID and an Intel 7- or 8-series chipset motherboard. If you have an Intel 6-series board or older, or an AMD system, you're SOL for now, and will have to use the SSD's built-in garbage collection instead. Theoretically, it should work just fine, so don't be afraid.



PCIe x8 vs. PCIe x16

PCIe expansion slots vary in both physical size and the amount of bandwidth they provide. The really long slots are called x16 slots, as they provide 16 lanes of PCIe bandwidth, and that's where our video cards go for obvious reasons. Almost all of the top slots in a motherboard (those closest to the CPU) are x16, but sometimes those 16 lanes are divided between two slots, so what might look like an x16 slot is actually an x8 slot. The tricky part is that sometimes the slots below the top slot only offer eight lanes of PCIe bandwidth, and sometimes people need to skip that top slot because their CPU cooler is in the way or water cooling tubes are coming out of a radiator in that location. Or you might be running a dual-card setup and if you use an x8 slot for one card, it will force the x16 slot to run at x8 speeds. Here's the question: since an x16 slot provides 3.2GB/s of bandwidth in one direction and an x8 slot pumps 1.6GB/s, is your performance hobbled by running at x8?

THE TEST: We wedged a GTX Titan into first an x16 slot and then an x8 slot on our Asus P9X79 motherboard and ran our gaming tests in order to compare the difference.

THE RESULTS: We were surprised by these results, which show x16 to be a clear winner. It seems obvious, but we didn't think even current GPUs were saturating the x8 interface – apparently they are, so this is an easy win for x16.

	GTX TITAN PCIE X16	GTX TITAN PCIE X8
3DMark Fire Strike	9,471	9,426
Catzilla (Tiger) Beta	7,921	7,095
Unigine Heaven 4.0 (fps)	40	36
Crysis 3 (fps)	32	37
Shogun 2 (fps)	64	56
Far Cry 3 (fps)	43	39
Metro: Last Light (fps)	25	22
Tomb Raider (fps)	25	23
Battlefield 3 (fps)	57	50

Tests performed on an ASUS P9X79 Deluxe motherboard.

	DDR3-1333	DDR3-1600	DDR3-2400
Stitch.Efx 2.0 (sec)	776	773	763
PhotoMatix HDR (sec)	181	180	180
ProShow Producer 5.0 (sec)	1,370	1,337	1,302
HandBrake 0.9.9 (sec)	1,142	1,077	1,037
3DMark Overall	2,211	2,214	2,215
Dirt 3 Low Quality (fps)	234	247.6	272.7
Price for two 4GB DIMMs (USD)	$85	$95	$120

Is high-bandwidth RAM worth it?

Today, you can get everything from vanilla DDR3-1333 all the way to exotic-as-hell DDR3-3000. The question is: is it actually worth paying for anything more than the garden-variety RAM?

THE TEST: For our test, we mounted a Core i7-4770K into an ASUS Z87 Deluxe motherboard and fitted it with ADATA modules at DDR3-2400, DDR3-1600 and DDR3-1333. We then picked a variety of real-world (and one synthetic) tests to see how the three compared.

THE RESULTS: First, let us state that if you're running integrated graphics and you want better 3D performance, pay for higher-clocked RAM. With discrete graphics, though, the advantage isn't as clear. We had several apps that saw no benefit from going from 1,333MHz to 2,400MHz. In others, though, we saw a fairly healthy boost, 5-10%, by going from standard DDR3-1333 to DDR3-2400. The shocker came in *DiRT 3*, which we ran in low-quality modes so as not to be bottlenecked by the GPU. At low resolution and low image quality, we saw an astounding 18% boost.

To keep you back on Earth, you should know that cranking the resolution in the game all but erased the difference. To see any actual benefit, we think you'd really need a tri-SLI GeForce GTX 780 setup and expect that the vast majority of games won't actually give you that scaling.

We think the sweet spot for price/performance is either DDR3-1600 or DDR3-1866.

DDR3-2400 RAM does yield some performance, but perhaps not enough to justify the higher prices.

	CORSAIR NEUTRON GTX IDE	CORSAIR NEUTRON GTX AHCI
CrystalDiskMark		
Avg. Sustained Read (MB/s)	224	443
Avg. Sustained Write (MB/s)	386	479
AS SSD - Compressed Data		
Avg. Sustained Read (MB/s)	210	514
Avg. Sustained Write (MB/s)	386	479
ATTO		
64KB File Read (MB/s, 4QD)	151	351
64KB File Write (MB/s, 4QD)	354	485
Iometer		
4KB Random Write 32QD (IOPS)	19,943	64,688
PCMark Vantage x64	6,252	41,787

IDE vs. AHCI

If you go into your BIOS and look at the options for your motherboard's SATA controller, you usually have three options: IDE, AHCI and RAID. RAID is for when you have more than one drive, so for running just a lone wolf storage device, you have AHCI and IDE. For ages we always just ran IDE, as it worked just fine. But now there's AHCI and it supports features IDE doesn't, such as Native Command Queuing (NCQ) and hot-swapping. Some people also claim that AHCI is faster than IDE due to NCQ and the fact that it's newer. Also, for SSD users, IDE doesn't support the TRIM command, so AHCI is critical to an SSD's wellbeing over time. But is there a speed difference between IDE and AHCI for an SSD? We set to find out.

THE TEST: We enabled IDE on our SATA controller in the BIOS and then installed our OS. Next, we added our Corsair test SSD and ran a suite of storage tests. We then enabled AHCI, reinstalled the OS, re-added the Corsair Neutron test SSD and reran all the tests.

THE RESULTS: We haven't used IDE in a while, but we assumed it would allow our SSD to run at full speed, even if it couldn't NCQ or hot-swap anything. And we were wrong. Dead wrong. Performance with the SATA controller set to IDE was abysmal, plain and simple. apc

AVOID THE BENCHMARKING PITFALLS

Even seasoned veterans are tripped up by benchmarking pitfalls, so beginners should be especially wary of making mistakes. Here are a few tips to help you on your own testing journey.

Put away your jump-to-conclusions mat. If you set condition A and see a massive boost – or no difference at all when you were expecting one – don't immediately attribute it to the hardware. Quite often, it's the tester introducing errors into the test conditions that causes the result. Double-check your settings and rerun your tests, and then look for feedback from others who have tested similar hardware to use as sanity check numbers.

When trying to compare one platform with another (certainly not ideal) – say, a GPU in system A against a GPU in system B – make sure you're especially wary of the differences that can result simply from using two different PCs and try to make them as similar as possible. From drivers to BIOS to CPU and heatsink – everything should match. You may even want to put the same GPU in both systems to make sure the results are consistent.

Use the right benchmark for the hardware. Running Cinebench 11.5 – which is a CPU-centric test – to review memory, for example, would be odd. A better fit would be applications that are more memory bandwidth-sensitive, such as encoding, compression, synthetic RAM tests or gaming.

Be honest. Sometimes, when you shell out for new hardware, you want it to be faster because no one wants to pay through the nose to see no difference. Make sure your own feelings toward the hardware aren't coloring the results.

THE ULTIMATE THUMB DRIVE TOOLKIT

Five ways to put your collection of neglected thumb drives to good use.

By Marco Chiappetta

Although they were once considered expensive luxuries to most users, USB thumb drives have become nearly as ubiquitous as the now defunct floppy disk. Thumb drives of all shapes and sizes are currently sold at supermarkets, freely disseminated at trade shows and even given out as digital business cards. Thumb drives are so commonplace now that it's not unusual for PC users to have amassed huge collections of drives that, for the most part, do little else but sit around collecting dust. We speak from experience.

While some of the drives you'll have lying around are likely to be small in terms of their usable capacity, that doesn't mean they're useless. Even thumb drives with capacities of only a few megabytes can still come in handy for creating things like bootable DOS disks, which can be used to flash the BIOS on an older motherboard or graphics card, or even bootable disks with a full-blown home theatre PC operating system.

We're going to cover a number of handy projects in this article that'll help put those neglected thumb drives to good use. Before we continue, though, a word of caution: all of these projects will destroy the data stored on the drives. If there's anything important on them, back it up before attempting any of the projects listed here. You'll be happy you did – trust us on this one.

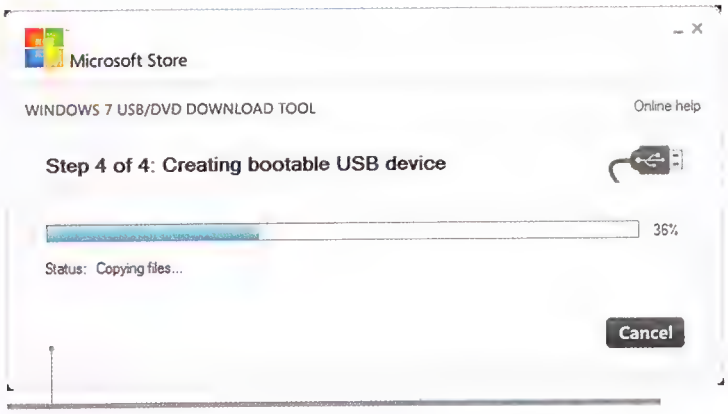
part 01

CREATE A CUSTOM WINDOWS INSTALL DISK

Speed up and minimise the hassle of installing Windows.

Many of us have installed Windows more times than we can count. With more recent versions of Windows, the installation process has become more streamlined, but it can still be a chore, especially if you're using optical media and have to manage multiple discs and product keys for all the different versions that are available. Thankfully, there's a faster and easier way to do it using a USB thumb drive.

There are a number of ways to create and customise a Windows installation disk. We're going to outline one of the easiest methods here using Microsoft's own Windows 7 USB/DVD download tool (the same process works with Windows 8) and a bit of file editing. When done, you'll have a Windows installation disk that can install any version of Windows – like Home Premium and Ultimate or Windows 8 and Windows 8 Pro – and it won't require a product key. There are much more involved methods for customising a Windows installation disk, which can also give users the ability to incorporate applications and drivers and even preconfigure many settings; for most enthusiasts, though, the method we'll outline here should still come in quite handy.



Microsoft's Windows 7 USB/DVD tool can prep a thumb drive and copy the installation files over in just a few simple steps.

GATHER YOUR MATERIALS

Before you begin, you'll need to have a USB thumb drive with a capacity of at least 4GB (larger is better if you want to store other files on the drive), ISO files for Windows 7 or 8 (a Google search will lead you to a legitimate source for the ISO you need, such as Digital River), a copy of Microsoft's Windows 7 USB/DVD tool (**tinyurl.com/mry6yqd**) and of course, a PC running Windows to complete the process. Note that the Windows 7 USB/DVD tool requires the .NET Framework to be installed on your machine, so you may need to install that, too.

INSTALL FILES TO DRIVE

Once you've got your ISO file(s) handy, connect the thumb drive to your system, note its drive letter, and then install and run the Windows 7 USB/DVD tool. On the initial screen, you'll be prompted to browse for the ISO file. Click the 'Browse' button, navigate to wherever you saved the ISO, click the 'Open' button and click 'Next'. On the subsequent screen, you'll be asked to choose your media type. The Windows 7 USB/DVD tool can create a bootable DVD or USB device. Since we're focused on thumb drives here, click the 'USB Device' button. On the next screen, select your thumb drive from the drop-down menu and then click the 'Begin Copying' button. The Windows 7 USB/DVD tool will format and prep the thumb drive, and then copy all the necessary installation files automatically.

When the Windows 7 USB/DVD tool is done doing its thing, close it and you're technically finished and ready to go. However, by default, the installer will only offer the option to install whichever version of Windows was designated by the ISO used to create the drive (Home Premium, Ultimate and so on). Windows 7 and 8's image-based installation method is capable of installing any edition of Windows (within the same family) with a bit of tweaking, though.

EDIT YOUR ISO FILE

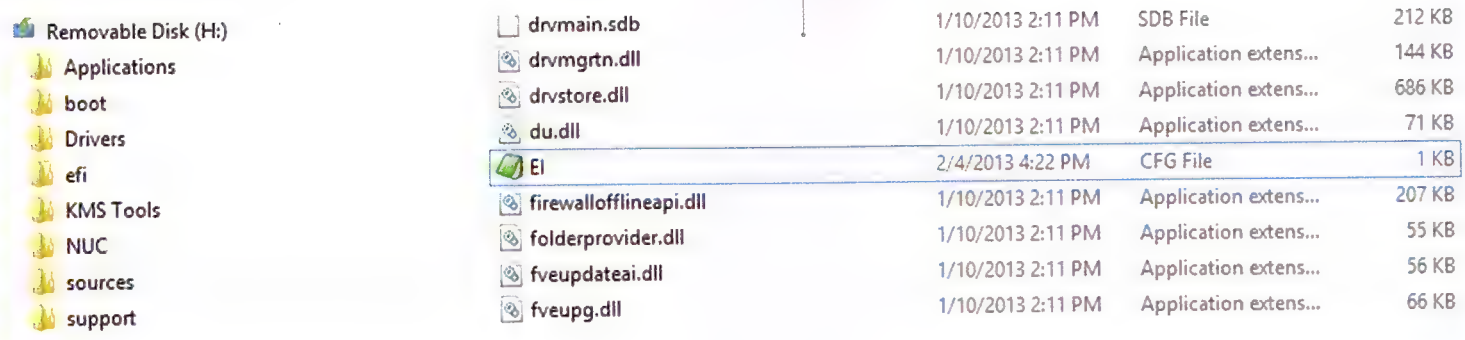
If you created a Windows 7 install drive, insert it into your PC and browse to the \sources directory. In that directory, delete the file 'ei.cfg'. With Windows 8 the process is a bit different. Create a text file named 'ei.cfg' (or edit the one you have if it's already there) with the following contents:

```
[Channel]
Volume
[VL]
1
```

Save the file and you're done.

THE RESULTS

So, how much time can you save by installing Windows from a USB thumb drive? When using a USB 2.0 flash drive, it took Windows 7 Ultimate 64-bit 6 minutes, 14 seconds to go from the 'Windows is loading files' prompt to the 'Completing installation' prompt on a Core i5 Dell laptop equipped with a 128GB SSD. Performing the same test with a USB 3.0 drive resulted in a time of only 5 minutes, 49 seconds. When timed using the Windows 7 installation DVD, however, the same process took 13 minutes, 51 seconds. That's a big time saving, especially if you find yourself installing Windows often. Store all of your favourite applications and most commonly used drivers on the thumb drive as well, and you can have them all installed right away, without having to swap a single disc.


Removable Disk (H:)
Applications
boot
Drivers
efi
KMS Tools
NUC
sources
support
drvmain.sdb 1/10/2013 2:11 PM SDB File 212 KB
drvmgrtn.dll 1/10/2013 2:11 PM Application extens... 144 KB
drvstore.dll 1/10/2013 2:11 PM Application extens... 686 KB
du.dll 1/10/2013 2:11 PM Application extens... 71 KB
EI 2/4/2013 4:22 PM CFG File 1 KB
firewallofflineapi.dll 1/10/2013 2:11 PM Application extens... 207 KB
folderprovider.dll 1/10/2013 2:11 PM Application extens... 55 KB
fveupdateai.dll 1/10/2013 2:11 PM Application extens... 56 KB
fveupg.dll 1/10/2013 2:11 PM Application extens... 66 KB

Deleting or editing the 'ei.cfg' file in the \sources directory on a Windows installation disk will allow different versions of Windows to be installed using the same media.

{ part 02 }

TAKE YOUR APPS ON THE GO

Portable apps let you use any PC without leaving a trace.

By far, one of the handiest things to do with a USB thumb drive is to create a mobile workspace, loaded up with portable apps. If you're unfamiliar with portable apps, they're essentially self-contained versions of programs that work entirely from their installation directory and don't leave any trace on the host PC. Once configured, you can take your thumb drive loaded up with portable apps anywhere, plug it in and all of your favourite applications and data will be right there waiting for you.

Portable versions of popular applications are freely available from many developers' web sites. Technically, all that's required to use a portable app is to download and install/run it right from a thumb drive. If you'd like to have a wide assortment of portable apps available, however, managing them all can get a bit unruly, since you can't simply create a directory of shortcuts – the shortcuts break if the thumb drive's drive letter changes. That's where the PortableApps Platform comes in.

ENTER PORTABLEAPPS

The PortableApps Platform is an easy-to-use launcher for managing and running portable apps. Download it from **www.portableapps.com** and install it to your thumb drive. While you're on the site, you can download a wide array of portable apps, too. Install the portable apps to the thumb drive and when you run the PortableApps Platform (by double-clicking the 'Start' application on the root of the drive), all of your apps will be listed in a 'Start' menu-like launcher.

Some of our favourite portable apps include Mozilla Firefox, FileZilla, 7-Zip, OpenOffice.org and GIMP. For the most part, if there's a popular open-source desktop application available, there's a portable version of it out there as well.

The PortableApps Platform gives you easy access to all of your portable apps from a single interface.

{ part 03 }

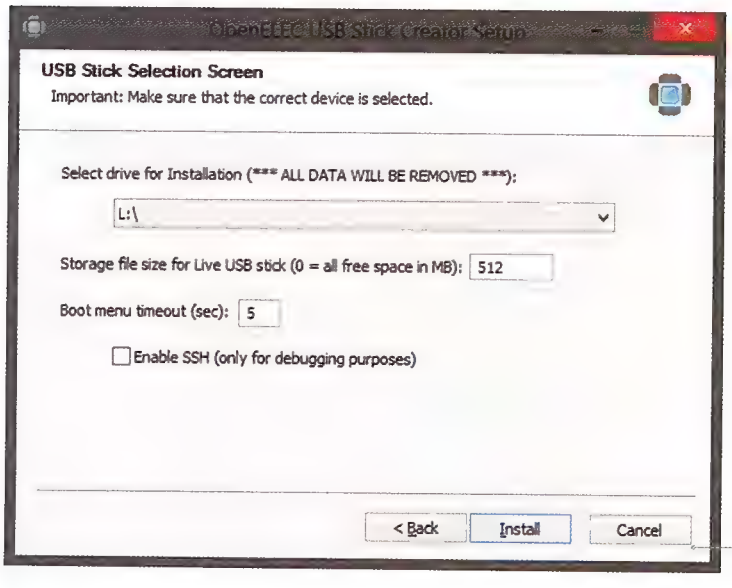
INSTALL A DEDICATED HOME THEATRE PC OS

Use OpenELEC on a thumb drive for media duties.

There's a lot of debate among home theatre PC enthusiasts. Some prefer their HTPCs to be Jacks-of-all-trades that run Windows and are as adept at playing movies as they are at running desktop applications. Others prefer their HTPCs to be simple boxes that are strictly for multimedia playback.

Well, why not have both?

The Open Embedded Linux Entertainment Center (OpenELEC) is a tiny Linux distribution that leverages XBMC (formerly known as the Xbox Media Center) and can be run right from a bootable thumb drive (or any other external drive, for that matter). With OpenELEC, your HTPC's internal drive can boot whatever operating system you like, but should you choose to go the streamlined route, you can boot from the OpenELEC-equipped thumb drive and quickly access your media.


OpenELEC USB Stick Creator Setup
USB Stick Selection Screen
Important: Make sure that the correct device is selected.
Select drive for Installation (*** ALL DATA WILL BE REMOVED ***):
L:\
Storage file size for Live USB stick (0 = all free space in MB):
512
Boot menu timeout (sec):
5
Enable SSH (only for debugging purposes)
< Back
Install
Cancel

OpenELEC includes a utility to prepare a bootable thumb drive containing the OS.

GET OPENELEC

If you'd like to give OpenELEC a try, go to **www.openelec.tv** and download the distribution that best matches your hardware. There are versions for AMD APUs, Intel processors and Nvidia Ion-based platforms among many others, with file sizes of only 80-125MB. Once you've got the distro downloaded, decompress it into a folder, and connect the thumb drive you'd like to use to your PC – it can be as small as a few hundred megabytes.

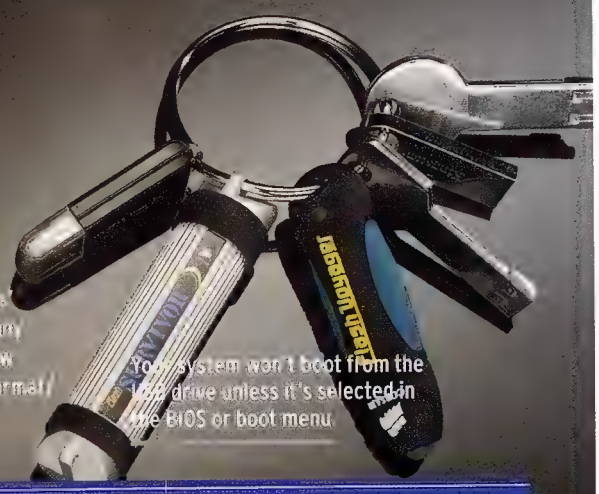
In the folder where you've decompressed OpenELEC, you'll find a file named 'create_livestick'. Double-click it and follow the onscreen prompts to prep the thumb drive and install OpenELEC. The process requires only four clicks: two to start the installation and accept the licence agreement, a third to select the thumb drive (which should be automatically identified) and a fourth to finalise the installation.

When the OpenELEC installation is done, connect the thumb drive to your HTPC and boot from it. On the initial splash screen, you'll be asked to either install it to the PC or run the live edition right from the flash drive. Run the live edition, configure XBMC to your liking and you're good to go.

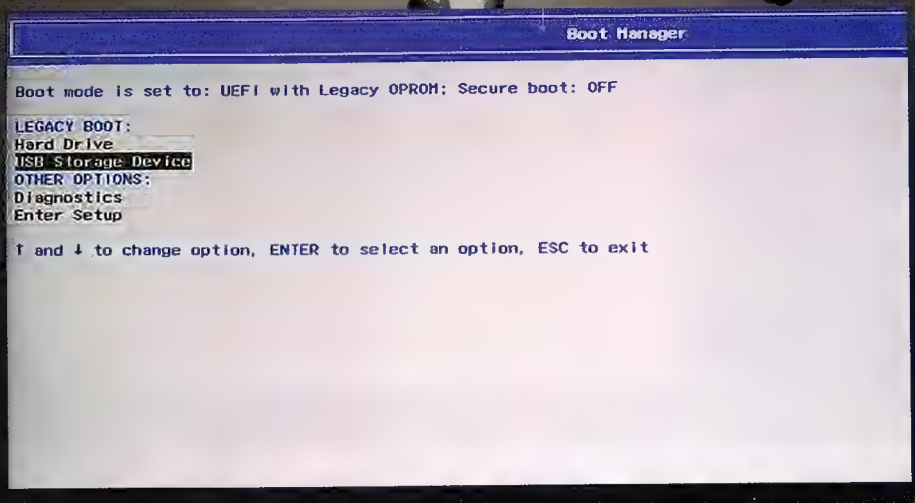
TROUBLESHOOTING: BOOTING FROM USB

All modern systems should offer the ability to boot from a USB drive, barring some corporate PCs that may have security measures in place to prevent it. Should you have problems booting from a USB drive on your personal system, though, there are a few things that could be at play. First, check that your system is configured to boot from the USB drive. Connect the drive, restart the system, enter the BIOS (usually by hitting Del or F2 during the POST) and under the 'Boot' menu, make sure the USB drive is being recognised and that it's first in the boot order. On many systems, you can usually hit F11 or F12 during the POST to load a one-time boot menu and select the USB drive there. You may also have to enable the option to boot from USB, depending on your motherboard manufacturer.

If none of that works, there's also a chance there's an incompatibility between your drive and a third-party USB controller. Plug your drive into a USB port that's native to your motherboard's chipset and then try booting again. Another possibility is some sort of corruption on the USB drive itself. As a last resort, copy all of the data from the drive to your PC and use Windows Diskpart utility to clean the USB drive of any partitions. You'll then need to create a new primary partition, set it to active and reformat/reconfigure the drive.



Your system won't boot from the USB drive unless it's selected in the BIOS or boot menu


Boot Manager
Boot mode is set to: UEFI with Legacy OPROM; Secure boot: OFF
LEGACY BOOT:
Hard Drive
USB Storage Device
OTHER OPTIONS:
Diagnostics
Enter Setup
↑ and ↓ to change option, ENTER to select an option, ESC to exit

{ part 04 }

CREATE THE ULTIMATE USB BOOT DRIVE

Arm yourself with the tools to meet any PC emergency.

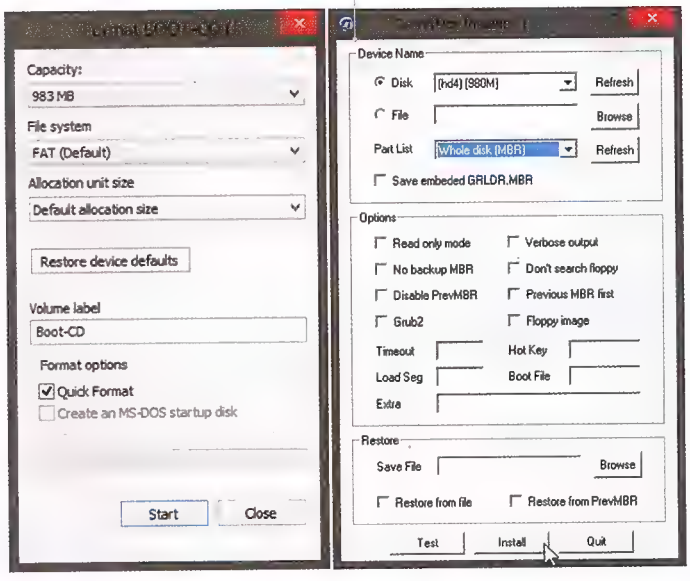
Every PC tech, amateur or pro needs a boot disk in their arsenal, jam-packed with various applications and utilities for recovering files and passwords, scanning for malware or disk defects, taking disk images and myriad other essential tasks. There are a handful of excellent options to choose from, but few offer as extensive a line-up of applications as Hiren's BootCD.

Hiren's BootCD (available for download from **www.hirensbootcd.org**) started its life as a less-than-savoury tool rife with pirated software. But the developers have since gone legit and replaced all of the pirated apps with excellent freeware alternatives. The Hiren's BootCD ISO is meant to be burned to a disc so it's write protected and insulated from malware, although it can also be written to a thumb drive using a couple of freely available utilities.

PREPARE YOUR DRIVE

To create a bootable thumb drive with Hiren's BootCD files, you'll need a drive with a capacity of at least 1GB, a copy of the Grub4DOS Installer (also available at **www.hirensbootcd.org**), the Hiren's BootCD ISO and if you're on Windows 7, a utility like WinRAR or 7-Zip to extract the necessary files from the ISO (Windows 8 can mount ISO files natively, so you won't need a separate utility). Once you've got everything gathered up, connect your thumb drive and format it using the FAT file system (right-click the drive in File Explorer and select 'Format' from the menu), to ensure the drive is free of any data. Then run the Grub4DOS Installer utility as an administrator. In the program window that opens, click the 'Disk' radio button and then select your thumb drive from the adjacent drop-down menu. Then, hit the 'Refresh' button next to the 'Part list' drop-down menu and select 'Whole disk (MBR)' from the associated drop-down. Click the 'Install' button at the bottom of the interface to install the Grub4DOS universal bootloader to your thumb drive – it'll only take a couple of seconds.

You'll need to install the Grub4DOS bootloader to your thumb drive before it'll run Hiren's BootCD.



POPULATE YOUR DRIVE

Once you've got the Grub4DOS bootloader installed, the next step is to copy all of the Hiren's BootCD files over to the thumb drive. Extract the files from the ISO (or mount it if you're on Windows 8) and copy all of the files and folders to the thumb drive. When all of the files have been copied over, navigate to the 'HBCD' folder on the drive and copy the 'grldr' and 'menu.lst' files within the 'HBCD' folder to the root of the drive. Once the 'grldr' and 'menu.lst' files have been placed on the root of the drive, it's ready to use.

{ part 05 }

CREATE A LINUX LIVE BOOTABLE KEY

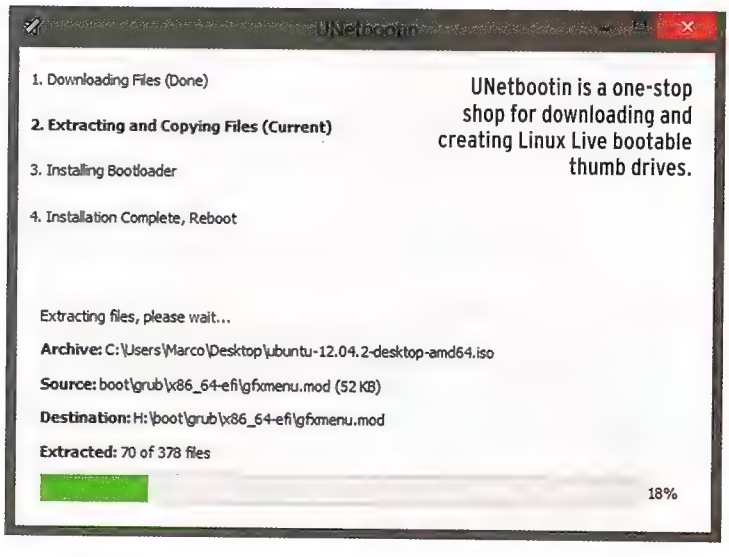
Try any version of Linux without altering your current system.

Most Linux distros, like Ubuntu, which we used for this project, run very well from a USB thumb drive.

Experimenting with different versions of Linux is a great way to utilise those thumb drives cluttering up your junk drawer. There are a ton of utilities out there that can help ease the setup process, but one in particular, the Universal Netboot Installer (UNetbootin for short), makes the entire process, from selecting and downloading a distro to prepping a thumb drive, about as easy as could be.

GET UNETBOOTIN

UNetbootin can be downloaded at **unetbootin.sourceforge.net**. It's a standalone utility that doesn't need to be installed. Once downloaded, simply double-click the file to run UNetbootin and on the initial screen you'll have two options: to either select a distribution to download and install (there are hundreds to choose from) or to create a bootable thumb drive using a pre-downloaded ISO. If you'd like to experiment with different Linux distros, UNetbootin will download and install them to your flash drive right from its main interface – there's no need to scour the web on your own. If you've already got some ISOs downloaded and just haven't gotten around to burning them, UNetbootin can use those, too. For the purposes of this project, we downloaded the popular Ubuntu Linux ISO, but just about any distro should work.



UNetbootin is a one-stop shop for downloading and creating Linux Live bootable thumb drives.

CREATE A LINUX LIVE DRIVE

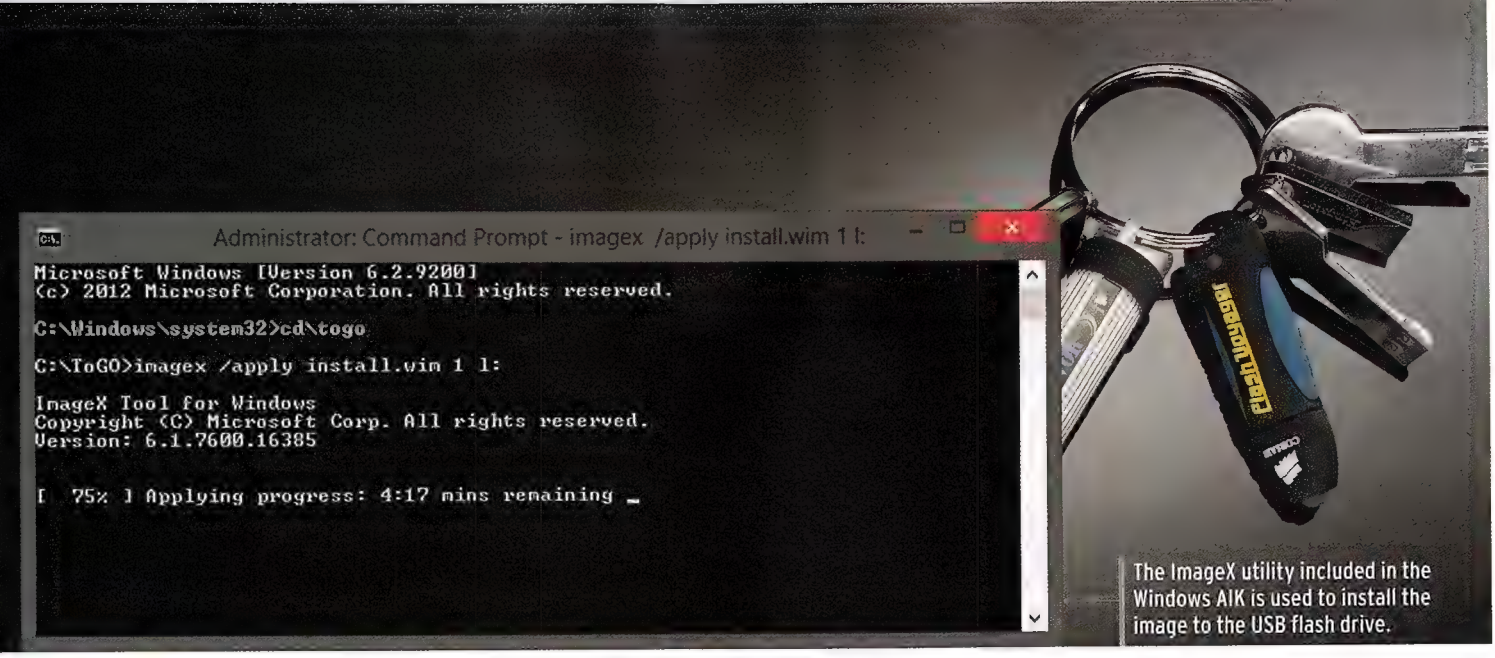
To create a Linux Live USB drive, UNetbootin extracts the necessary files from an ISO, copies them to the thumb drive, generates an appropriate config file and then makes the drive bootable. To use UNetbootin, connect your thumb drive to your PC, run the utility and download a distro (or choose your pre-downloaded ISO) right on the initial screen. The thumb drive should be a few hundred megabytes at minimum, but larger (think 2GB plus), faster drives are preferable. Once you've chosen the distro and selected the thumb drive from the menu, click the 'OK' button and UNetbootin will download and/or extract the necessary files and automatically copy them to the thumb drive. The utility will then make the drive bootable and when it's complete, UNetbootin will prompt you to exit or to restart the system, should you want to give the thumb drive a try right away.

PUT IT TO USE

To use your Linux Live bootable thumb drive, simply boot to it and at the UNetbootin menu, select 'Try Ubuntu without installing' (or whichever distro you chose). The OS will run right from the thumb drive as if it were installed locally on the host PC.

Linux Live bootable drives are particularly useful for not only learning your way around Linux, but also as pseudo-recovery disks as well. If you've got a Windows PC that won't boot and you need to recover files, booting to a Linux Live drive may allow you to access the system's hard drive and copy whatever files you may need.

The UNetbootin boot menu gives you the ability to run Linux right from the thumb drive or install it to the host PC.


Administrator: Command Prompt - imagex /apply install.wim 1 1:
Microsoft Windows [Version 6.2.9200]
(c) 2012 Microsoft Corporation. All rights reserved.
C:\Windows\system32>cd\togo
C:\ToGO>imagex /apply install.wim 1 1:
ImageX Tool for Windows
Copyright (C) Microsoft Corp. All rights reserved.
Version: 6.1.7600.16385
[75%] Applying progress: 4:17 mins remaining _

The ImageX utility included in the Windows AIK is used to install the image to the USB flash drive.

{ part 06 }

SET UP A WINDOWS TO GO ENVIRONMENT

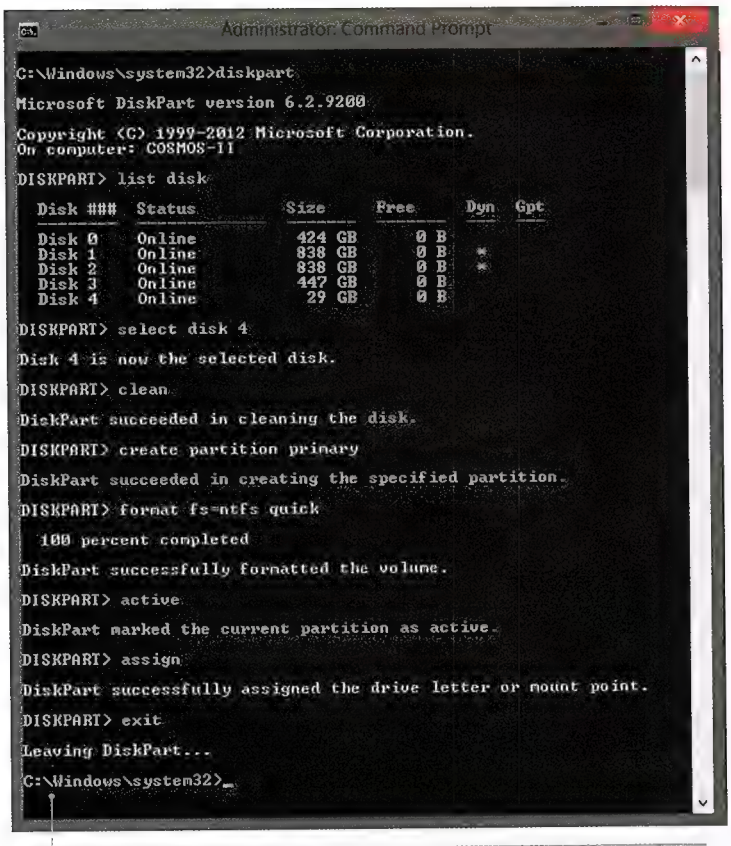
The perfect excuse for buying a new USB 3.0 thumb drive.

One of the coolest new features of Windows 8 is its ability to run from a USB thumb drive, called 'Windows to Go'. With it you can install Windows 8 and your favourite apps and tools to a thumb drive, plug it into a PC, boot from it and your entire workspace will be available. To create a Windows to Go environment, you need a 32GB USB 3.0 thumb drive, a Windows 7 or 8 PC to configure the drive (Windows 8 is preferable due to its native ability to mount ISO files), Microsoft's Automated Installation Kit (**tinyurl.com/cpugbrl**) and a Windows 8 installation disc or ISO.

FIRST THINGS FIRST

If you've got everything available and downloaded, install the Windows AIK first. It'll create a \Program Files\Windows AIK directory with a number of other directories within. In the \Tools subdirectory, you'll see a number of other subdirectories labelled with specific system architectures. If you're creating the Windows to Go drive on a system running a 64-bit edition of Windows, open the \amd64 folder. If you're running a 32-bit edition of Windows, open the \x86 folder. In those folders you'll see a file named 'ImageX.exe'. Copy this file and place it into a new subdirectory of your choosing – we used C:\ToGo.

Once you've got the correct ImageX utility copied, you need to extract the Windows installation image from the Windows 8 ISO. Mount the ISO (or extract it to a folder) and in the \sources directory, find the file labelled 'install.wim' and copy it to the same directory in which you placed the ImageX utility.


Administrator: Command Prompt
C:\Windows\system32>diskpart
Microsoft DiskPart version 6.2.9200
Copyright (C) 1999-2012 Microsoft Corporation.
On computer: COSMOS-II
DISKPART> list disk
Disk ### Status Size Free Dyn Gpt
Disk 0 Online 424 GB 0 B
Disk 1 Online 838 GB 0 B *
Disk 2 Online 838 GB 0 B *
Disk 3 Online 447 GB 0 B
Disk 4 Online 29 GB 0 B
DISKPART> select disk 4
Disk 4 is now the selected disk.
DISKPART> clean
DiskPart succeeded in cleaning the disk.
DISKPART> create partition primary
DiskPart succeeded in creating the specified partition.
DISKPART> format fs=ntfs quick
100 percent completed
DiskPart successfully formatted the volume.
DISKPART> active
DiskPart marked the current partition as active.
DISKPART> assign
DiskPart successfully assigned the drive letter or mount point.
DISKPART> exit
Leaving DiskPart...
C:\Windows\system32>_

Use Windows' built-in Diskpart utility to clean the flash drive, create an active primary partition and format it with the NTFS file system.

PREP YOUR DRIVE

With ImageX and the Windows 8 'install.wim' file copied, it's time to prep the flash drive. Connect the drive to your system, then open a command prompt as an administrator and run Diskpart. At the Diskpart prompt, first type `list disk` and hit Enter to see a numerated list of drives connected to your system – on our machine, the thumb drive we wanted to use was listed as 'Disk 4'. When you know the number of your thumb drive, type `select disk 4` (replace `4` with the number of your drive) at the Diskpart prompt and then hit Enter again. Once the proper drive is selected, you've got to run a handful of commands to clean, repartition and reformat the drive in preparation for the Windows to Go installation. Type the following commands in succession, hitting Enter after each one: `clean`, then `create partition primary`, then `format fs=ntfs quick`, then `active` and then `assign`. Exit the Diskpart utility and navigate to the directory where you placed the ImageX and 'install.wim' files. Since we used C:\ToGo, at the command prompt we typed `cd\ToGo` and hit Enter.

INSTALL WINDOWS

The next step is to actually install Windows to the flash drive using ImageX. At the command prompt, type: `imagex /apply install.wim 1 X:`, where `X` is the drive letter of your flash drive. This command tells ImageX to apply the first image within the 'install.wim' file to drive letter X. The installation process will take a good 15-20 minutes or so, depending on the speed of your drive. Once the ImageX process is complete, the next step is to install the correct boot record. While still at the command prompt, type `bcdboot.exe X:\windows /s X: /f ALL` (again, replace `X` with the drive letter of your thumb drive) and hit Enter. This command tells the bcdboot utility to install the boot record from the X:\windows directory to the root of the drive.

Once the boot record is installed, your Windows to Go drive is ready to use. The first time you boot to it, it'll detect new hardware and configure the necessary devices, but it'll eventually load the Modern UI and behave just like a local Windows installation. Activate the OS, install your applications and any necessary drivers, and you're done.

GOT START?

You can wait all you want, Microsoft isn't going to return the beloved 'Start' menu to Windows 8. But hope is not lost, thanks to these handy third-party tools!
By David Murphy

BEYOND ALL of the colourful tiles; the bolted-on Modern user interface; the giant, full-screen apps and panels; and the inability to boot to the desktop – to name just a few of our gripes – there's one issue above all others that's guaranteed to universally frustrate Windows 8 desktop users: the 'Start' menu.

Specifically, Microsoft's decision to remove the 'Start' menu entirely from Windows 8, giving users no recourse for adding it back as an optional alternative or supplement to the Modern UI's tiled application shortcuts and search tool, which are Windows 8's means of navigation.

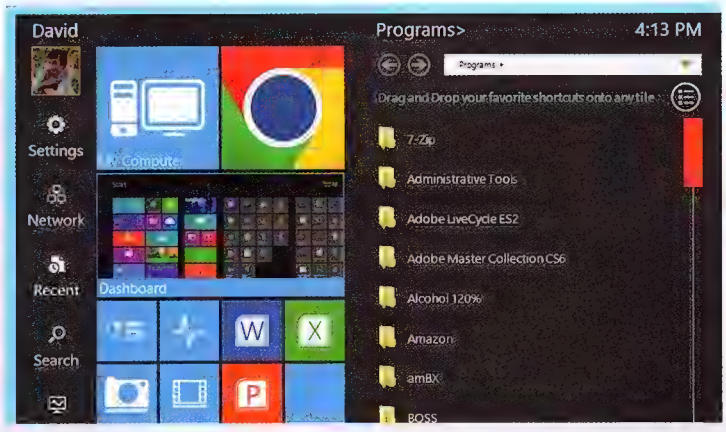
We can fix that. Perform a simple search for **Windows 8 Start Menu** and you'll find a smorgasbord of apps with one purpose in mind: bringing back the button at any cost. The last thing you want to do is muck up your Windows 8 installation with a junky program, however – worse, to have wasted your time installing numerous 'Start' menu apps in an effort to find out which one is best (or prettiest).

Worry not. Your 'Start' menu is coming back. And with 11 different apps in our 'Start' menu roundup, we're going to show you the best free and paid-for ways to get it.

FREEWARE

START MENU REVIVER

It's a 'Start' buffet, not a 'Start' menu.



We appreciate what ReviverSoft is trying to do with its free Start Menu Reviver app. In many ways, the 'Start' menu that the app creates is like a miniature hybrid of Windows Modern UI and a conventional 'Start' menu. Big, bulky boxes give you access to your computer's contents, your internet browser of choice, the Modern UI dashboard and what can only be described as a semi-shrunken version of the Modern UI itself for quick app access.

With a little bit of tweaking of Start Menu Reviver's limited configuration options, you can create a vague resemblance to the conventional 'Start' menu. Even then, the app feels like it wastes space – we'd rather see more of our folders and shortcuts at once.

To balance out that annoyance, however, the app features a ton of links to various parts of the OS, along with the ability to bypass the Modern UI completely when Windows 8 boots.

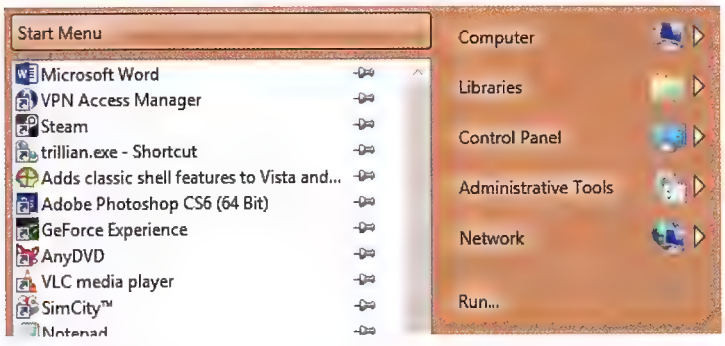
www.reviversoft.com

HIGHLIGHTS
- Packed to the gills with links and shortcuts.
- Not a ton of configuration options on this one.
- 'Start' menu folder structure could be presented much better.

FREEWARE

POWER 8

We give it a Power 1



Sorry, Power 8 just doesn't do it for us. First of all, we hate that there's no way to assign your keyboard's Windows Key to pull up this app's 'Start' menu instead of the Modern UI. The app is also a little too thorough when it comes to disabling the Modern UI's hot corners – it's useful if you want to try and click its tiny 'Start' button without accidentally activating a Windows 8 hot corner, but poor if you want to access any hot corner options.

About that 'Start' button – we also wish that Power 8 came preconfigured with a larger button than the tiny sliver the app stashes on the lower-left corner of your screen. The app's glowing shortcut text is a bit tough on the eyes and you're forced to click a giant 'Start Menu' button within the, er, 'Start' menu, just to access your standard Programs folder. No, thanks.

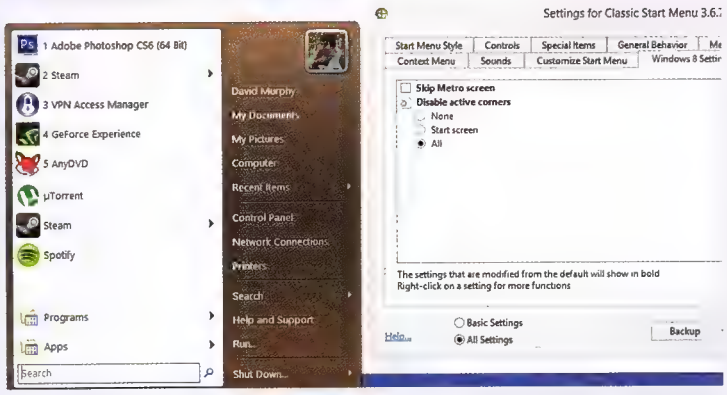
code.google.com/p/power8

HIGHLIGHTS
- Big on pinning, if there's a small list of apps that you only really ever use.
- Doesn't work with your Windows Key, disables too much of the Modern UI with no customisability.

FREEWARE

CLASSIC SHELL

Swiss Army knife of 'Start' menu approaches.



The freeware app Classic Shell is a bit like using a bazooka to kill a fly. In this case, we commend the carnage. Once installed, the app allows you to slap a 'Start' menu button directly within Windows 8's desktop mode, which can be configured to operate in one of three ways: Windows Classic, Windows XP or Windows 7.

And, yes, Classic Shell comes with illustrated examples for those who don't quite remember the differences between the three 'Start' menu setups.

Other fun tweaks the app enables are the much-longed-for ability to bypass Windows 8's Modern UI entirely in favour of a direct boot to desktop mode, a sea of configuration options that you can use to tweak your 'Start' menu to your liking, as well as Classic Explorer, which adds some creative visual tweaks to File Explorer itself!

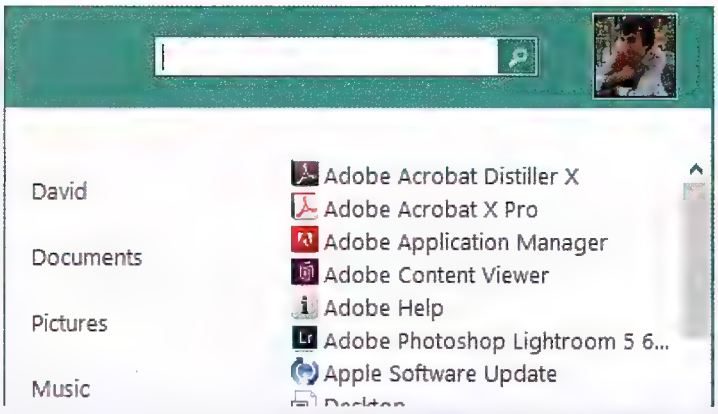
www.classicshell.net

HIGHLIGHTS
- A great app for ignoring the Modern UI completely.
- Highly customisable, with more options than Windows would give you natively.
- Bonus tweaks to File Explorer, which you can enable and disable at your leisure.

FREEWARE

VISTART

Not too shabby, minus its weird name.



It might feel a bit jarring at first when ViStart asks you to create a new toolbar that it'll use as your 'Start' button, but don't be scared off by the app's treatment. You can still tap your Windows Key to launch the new menu – or at least we could, until the Windows Key started loading the Modern UI again (a quick reset fixed that).

ViStart's scrolling programs menu mimics the conventional Windows 7 'Start' menu and its left-most shortcuts are both convenient and customisable – you can even add brand-new ones if you're down for a little bit of text file editing. The app lets you bypass the Modern UI upon booting and customise which of Windows 8's hot corners you'd like to flip on and off – a lovely touch.

However, the app's search leaves a little to be desired, as you can't Ctrl-A all of your text and delete it en masse when you want to search for new things.

lee-soft.com/vistart

HIGHLIGHTS

- Simple look and feel with a variety of switchable skins and decent display configuration.
- Scrolling programs menu should be replaced with one that shows all of your programs and folders at once.

FREEWARE

STARTW8

Simple, easy, could be a bit more customisable.

The no-frills freeware app StartW8 throws up a fairly simplified iteration of Windows 7's 'Start' menu within your Windows 8 installation, up to and including the familiar scrollable list of folders and shortcuts buried within its 'All Programs' link.

It's a bit of a bummer that StartW8 doesn't come with a way to pin frequently-used shortcuts to the 'Start' menu itself, or even change the order in which your shortcuts appear in StartW8's 'recent' section.

Nestled within StartW8's settings menu is an option that lets Windows 8 skip away from the Modern UI and pull up the Windows desktop when the OS loads. You're also allowed to disable the Modern's UI hot corners in various configurations – we appreciate that StartW8 resists an all or nothing approach. StartW8 lets you edit the menu items that the app tosses on the right-most part of the 'Start' menu, but you can't customise your own shortcuts.

www.areaguard.com/startw8

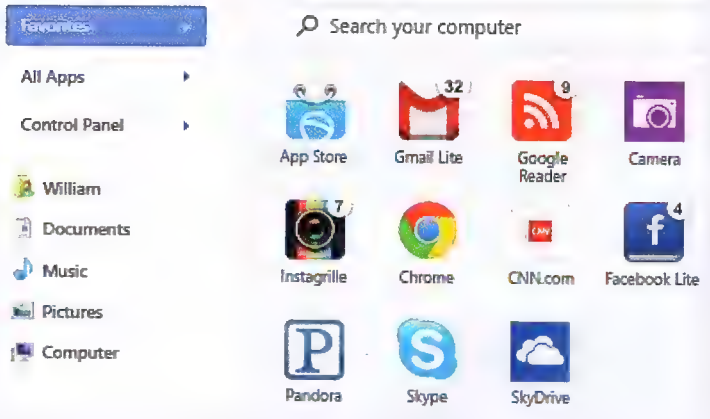
HIGHLIGHTS

- A few-frills 'Start' menu app that gives you a classic, compact look.
- You can't really manipulate your typical 'Start' menu shortcuts (our kingdom for a 'pinning' option!).

FREEWARE

POKKI

A lovely looking Start Menu... if it installs



Pokki isn't so much a 'Start' menu replacement as it is a kitchen sink of utilities for the social enthusiast. In theory, the app gives you a brand-new 'Start' menu in Windows 8 that's packed full of far more than you probably need on your 'Start' menu, including hooks to an app store that you can use to supplement your Pokki 'Start' menu with social networking tie-ins, games and other web-themed fare.

The problem? It doesn't work. We had a great deal of trouble getting Pokki installed on our 64-bit system – either the app would install 'correctly' and just not do anything (or even give the appearance that it was installed on our system) or the installation program would just hang and hang and hang. Trying to uninstall Pokki after an unsuccessful installation informed us that we didn't have sufficient rights to do so. Argh.

www.pokki.com

HIGHLIGHTS

- 'Start' menu certainly looks pretty, but we're wary of additional tie-ins.
- Frustrating installation setup in that it didn't work out for us at all.
- Perhaps Windows 8 64-bit users need not apply?

FREEWARE

START MENU 7

Display all the apps.

Boom! That's the sound Start Menu 7 should make the first time you click its four-colour icon and get all of your programs blasted across your screen on one of the largest 'Start' menus we've ever encountered. Thankfully, you can adjust the menu's height and width as if it were a standard Windows... window.

You can configure Start Menu 7 to load itself or the Modern UI's 'Start' screen via your keyboard's Windows Key (or Shift+Windows Key combination). Flipping Windows 8's hot corners on and off is as easy as clicking the available graphic and yes, Start Menu 7 can bypass the Modern UI when your system boots.

The app comes with five different skins for its 'Start' menu. More importantly, you can use the app to create 'virtual groups' of folders and shortcuts for extra organisation. The app's 'pinning' process for sticking shortcuts to the 'Start' menu could be a bit more streamlined, however.

www.startmenu7.com

HIGHLIGHTS

- All of your apps in one giant 'Start' menu!
- Virtual folders can help get your shortcuts a bit more organised.
- Creating a 'favourites' list of shortcuts is a little annoying.

WHAT'S NEW IN WINDOWS 8.1?

As we were going to press, Microsoft finally announced a release date of October 18 for Windows 8.1, a Service Pack-like update to Windows 8 that brings a number of mprovements to the OS.

The biggie? The 'Start' button is back, but don't get your hopes too high – Microsoft isn't building a 'Start' menu back into Windows 8's desktop mode. Instead, users are just going to get a quick shortcut to the Modern's UI 'All Apps' mode, with the added bonus that they'll now be able to rearrange apps instead of being stuck with Windows' current alphabetical implementation.

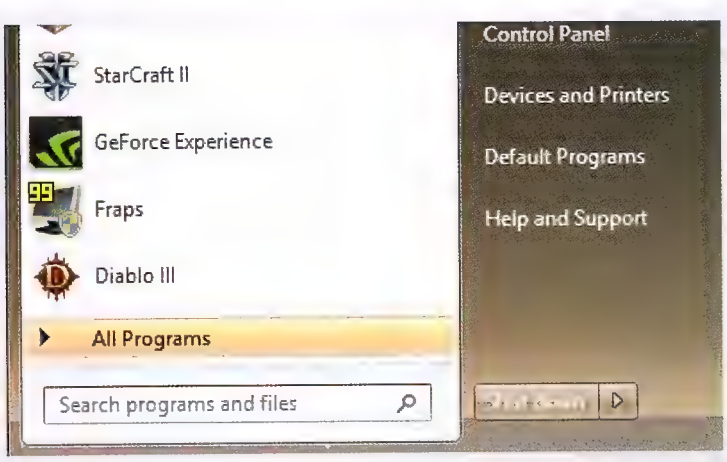
Users will also be able to set a single wallpaper image that spans both Windows 8's desktop mode and 'Start' screen, which has the potential to alleviate some of the unpleasantness that comes from switching between the two UIs.

Those who actually use the Modern UI might appreciate the fact that Microsoft is throwing two additional tile sizes into the mix, and those who dislike the UI will enjoy the 'Boot to Desktop' functionality which allows haters to bypass the Modern UI entirely when Windows 8 starts up.

PAIDWARE

STARTISBACK

A Windows 7 'Start' menu with little to no fuss.



As an Irish lad, this reviewer does appreciate that StartIsBack uses a shamrock embedded in an orb as the default icon for the 'Start' menu it jury-rigs into your OS.

Even better, the 'Start' menu itself looks and operates swimmingly – as if you ripped it straight out of Windows 7 and dumped it into Windows 8. In fact, we'd assume you were just natively running Microsoft's older OS if you sat us down at Windows 8's desktop mode with StartIsback running. It's that slick.

StartIsBack comes with a number of configuration options for tweaking the look and feel of your 'Start' menu. The app also lets you bypass the Modern UI entirely when booting, though it also gives you a host of options for configuring its hot corners.

Our favourite trick? The option that lets you sticky a taskbar within the Modern UI itself. Take that, Windows 8 UI design.

US$3, www.startisback.com

HIGHLIGHTS

- Slick, smooth and problem-free recreation of the Windows 7 'Start' menu.
- Tons of configuration options.
- You'll have to download a new 'Start' menu orb if you're not a big Ireland fan.

PAIDWARE

RETROUI PRO

More features than a standard 'Start' menu.

We like the look of RetroUI Pro, but some of its raw functionality and default configurations leave a little to be desired. For starters, we hate this 'Start' menu's 'pinning' feature, which requires you to click into a separate 'edit mode' to sticky your most frequently used apps to your 'Start' menu. A simple, ever-present 'pin' icon could have solved this bit.

We also think it's weird that Modern UI apps appear by default within your 'Start' menu's 'All Programs' listing, although this is a feature you can thankfully switch off within RetroUI Pro's settings. You can also configure away the Modern UI's hot corners, but you can't specify which you'd like to toggle on or off – it's all or nothing. At least RetroUI Pro really lets you tweak the links that appear on the 'Start' menu itself.

Additionally, RetroUI Pro's 'Enforce' technology does a great job of sticking your taskbar to the bottom of the screen when you run Modern UI apps.

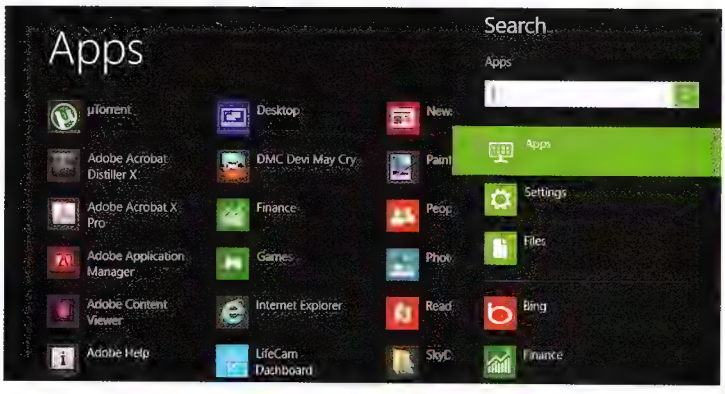
US$4.95, retroui.com

HIGHLIGHTS
- Plenty of customisation.
- Built-in Modern UI 'Start' menu skin is atrocious – stick with Windows 7.
- 'TabletView' gives you more of a visual, Modern UI-like shortcut list for launching apps.

PAIDWARE

START8

Good looks meet powerful customisability.



As far as looks go, Start8 presents a very convincing replica of the Windows 7 'Start' menu with a few fun twists. First up, switching between that and a Windows 8-themed 'Start' menu – a mini Modern UI, as it were – is super-easy to do within Start8's simple configuration app. It's as easy as changing the skins on the Windows 7 'Start' menu and you get five of those to choose from.

As an aside, we love how all of your configuration changes occur in real time within the 'Start' menu, which is useful for testing out particular settings.

Start8 allows you to customise the various shortcuts that appear on the right side of the 'Start' menu, including adding shortcuts to any custom locations you want. You can set how you want your Windows Key to work and how the Modern UI's hot corners should run, and yes, Start8 lets you boot right into desktop mode as well. Delightful!

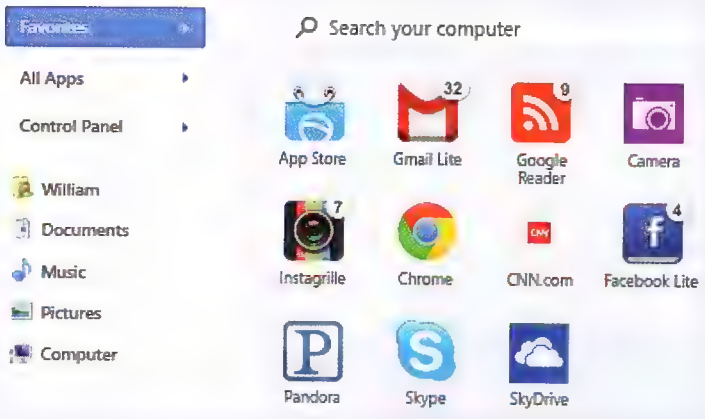
US$4.99, www.stardock.com

HIGHLIGHTS
- Powerful functionality and multi-monitor options.
- Adding 'Start' menu shortcuts to custom locations on your system is a breeze.
- No way to sticky your taskbar to the bottom of the Modern UI.

PAIDWARE

STARTMENUPLUS8

This isn't a Start Menu; this is a punishment



StartMenuPlus8's official web site looks a bit like a cross between a newbie Geocities site and a seizure, and we're glad to see that the app itself follows suit – consistency's important.

The 'Start' menu button that StartMenuPlus8 creates on your taskbar is just a standard pinned application. You have to drag it over to the left-most slot on your taskbar to mimic a 'Start' button and even then, you get no way to disable Windows 8's hot corners within the app.

It's hard to describe just how strange this app is, from its less-than-pleasing white-on-black colour scheme, to its absurd amount of white space within the 'Start' menu itself, to the absurd level of unnecessary, difficult-to-parse detail packed into its single configuration window. You can't fire up the 'Start' Menu and start typing out a search, and some of the app's own shortcut names don't even fit on its 'Start' menu screen. Yuck.

US$4.99, www.winok-msixray.com

HIGHLIGHTS
- Ugly
- Impractical
- We'd rather stick with the Modern UI.

FIVE OTHER WAYS TO TWEAK WINDOWS 8

If you want to spruce up the look of the rest of your operating system, we've got you covered!

It's been a year and change since the launch of Microsoft's Windows 8 OS and it feels as if there's still a dearth of apps for tweaking the operating system proper – besides all of the aforementioned 'Start' menu programs, of course. Still, we've identified five apps that do a pretty great job of making Windows 8 prettier at the very least and in some instances, add new functionality that will enhance your new Modern UI lifestyle. Now that you've souped up your 'Start' menu, it's time to tackle the rest of the OS!

MODERNMIX

If you can't stand the full-screen takeover brought on by the Modern UI portion of Windows 8, then ModernMix is worth the cost of lunch. This super-useful app allows you to run Modern UI apps as if they were standard applications, run in standard windows, right from Windows 8's desktop mode. You can customise the size of the Modern UI apps themselves – in case you need a huge weather display, but just a tiny window for Skype – and you can pin them to your taskbar for easier access from your conventional desktop.
US$4.99, www.stardock.com

DECOR8

We're big fans of those greyscale Windows 8 'wallpapers' for the Modern UI's 'Start' screen – no, we're not being sarcastic. Even though they look a bit like someone pulled up their favourite Photoshop brush and went to town for a few minutes, they do add a pleasant aesthetic to the Modern UI's tiled interface.

But you know us – we like customisation. The app Decor8 unlocks the ability to turn any background you want into a wallpaper for your 'Start' screen. You can randomise the backgrounds to set intervals if you want your 'Start' screen to always look new and fresh, and the app will even automatically select a new colour scheme for your tiles based on the colours of the background image you've selected.

Yes, the Windows 8.1 preview adds this functionality, but it could be an interim solution while you wait for the final version.
US$4.99, www.stardock.com

CHAMELEON

The customisation continues! Now that we've successfully freshened up the look of your 'Start' screen, it's time to give your 'Lock' screen a little bit of love – assuming you haven't already used Windows 8's Group Policy Editor to bypass the 'Lock' screen entirely. Chameleon, found via the Windows Store, isn't the most intuitive of Modern UI apps. However, what it lacks in instruction, it makes up for in comprehensiveness. Using the app, you can have Windows 8 automatically update your 'Lock' screen's background at set intervals using a number of images from your computer's photo library or various online sources, including NASA's Astronomy Picture of the Day and Bing's Picture of the Day, to name a few.
Free, Windows Store

OBLYTILE

If there's one thing we especially detest about the Modern UI's interface, it's that system tiles and downloaded apps get all the eye candy and our poor, simple shortcuts get ignored. The free OblyTile doles out a little love for your ugly-looking shortcuts by giving you the opportunity to customise them with their own thumbnail image, background colour and text colour. Who needs the Modern UI's tile grouping functionality when you have colour coordination, anyhow?
Free, oblytile.en.softonic.com

ULTRAUXTHEMEPATCHER

This one's simple. If you want to be able to install third-party themes within Windows 8 (as in community-created themes instead of those bestowed from Microsoft directly), you're going to need to patch your operating system with this simple tool. UltraUXThemePatcher is free, it's fast and it even backs up the original files it overwrites in case you need to uninstall the utility for some reason.
Free, ultrauxthemepatcher.en.softonic.com

Experts solve your computing problems

APC and its readers can be one giant helpdesk. If you have a technical problem, chances are one of us can solve it.

WINDOWS

REMOVE FILES, KEEP OS

Q I am giving my old laptop to a friend and I would like to delete everything but Windows 7 Ultimate. I have done some Googling on this and it seems the best result is to use 'Add and Remove Programs' applet in 'Control Panel'. But that doesn't get rid of documents, pictures and so on. I don't want to reinstall Windows because it's a real pain to do so. What do you suggest?
Daniel Tassone

A Assuming your photos and documents are all in your user folder ('My Documents', 'My Photos', 'My Videos' and so on), you can delete them by removing your user account. If your user account is the only one on the computer, you'll need to create a new one first. Then go to 'Control Panel > User Accounts and Family Safety > Manage Another Account'. Select the user account with the data you'd like to delete and then click 'Delete the Account'. You'll be given an option to keep or delete the files associated with it; make sure to delete them.

Cooling is vital for a gaming rig.

After this, you should do a once-over of the rest of your hard drive, including your 'Downloads' folder and shared folders, to make sure there aren't still personal files in them. Be sure to empty the 'Recycle Bin' before you hand over the computer. If you're really paranoid, you might want to run Eraser (free from **eraser.heidi.ie**) to pave over the empty space to prevent someone from recovering data.

HARDWARE

BAD CMOS?

Q My PC died on me in the morning. The night before, I was playing Medal of Honor and everything was OK. After I woke up, I switched on the PC and got a 'BAD CMOS' message. I entered the BIOS, set the date and time, checked if everything was OK, saved and restarted, but the 'BAD CMOS' message came back. I switched off the PC, checked the CMOS jumper and changed the CMOS battery. Then out of the blue, the PC switched on for five seconds and off again.
Mokgale Seshabela

A That sounds more like a PSU fault. We think the CMOS checksum error is a secondary symptom of the failing PSU, rather than the primary cause. There are motherboard faults that can cause this as well, but swapping the PSU is usually a much cheaper piece of exploratory surgery than replacing the motherboard. Try that first and see if it fixes the problem. If it does, don't forget to swap the old PSU back again to confirm the problem comes back before you declare victory. If you stop as soon as the problem goes away without confirming your hypothesis, all you have is superstition.

GRAPHICS CARDS

OVERHEATING CARDS

Q I've got a solid gaming setup right now with a Core i5-750 at 3.2GHz on an ASUS Maximus III Formula and 16GB of PNY Optima RAM. My problem is my two EVGA Superclocked GTX 550 Ti cards in SLI. Housed in a HAF 922 chassis, I'm idling at 60°C and 40°C, and hitting 95°C and 80°C, respectively, under load, which is dangerously close to the 100°C maximum safe operating temperature. Ambient room temp isn't an issue and the Core-i5 stays under 40°. What would be the best option? I can go to a single GPU, though the 550s are super-effective in gaming. I could get aftermarket cooling for the 550s. Or should I just get an even bigger tower?
Vivaldi

A Have you tried adding an intake fan to the case's side panel? The Cooler Master HAF 922 can support another 20cm fan on the side. It's not the most elegant airflow solution, but blowing cold air directly onto the GPUs will help bring temperatures down.

Aftermarket cooling for your 550ss probably isn't worth the expense. Put that money toward your next single-card setup when the 550s can't keep up with your needs anymore.

SOFTWARE

THE BLACK SCREEN OF DEATH

Q My laptop is a Proline W258CUQ. I was installing avast! Antivirus and while it was busy loading, the screen went black. The only thing you can see is the cursor – it's moveable, but nothing else. I have tried restarting it, taking out and putting in the battery, and still nothing.
Bongani Twala

A This is a known problem. avast! incorrectly flags Windows 8's 'explorer.exe' as suspicious and disables or quarantines it in some way. That obviously prevents Windows from starting up normally.

If you hit Ctrl+Alt+Delete at the black screen, you should still be able to launch the 'Task Manager'. Rather than just shutting down avast!, switch to the 'Startup' tab, right-click 'avast!' and select 'Open file location'. In that folder, you'll see a file called 'AvastUI.exe'. Double-click that and click 'Security > Behaviour Shield > Settings'. Click 'Trusted Processes' and add 'C:\Windows\explorer.exe' to the list. Add 'C:\Windows\ImmersiveControlPanel\SystemSettings.exe' as well because this one also causes problems.

HARDWARE

SLEEPING MONITOR

Q I built my PC years ago and it has served me well. As it's quite old, it takes a while to boot up, so I always hibernate the system rather than shut it down to save time. A few weeks ago, when I switched my PC on, the lights came on and the hard drive was whirring, but the monitor went into power-saving mode. I could only wake it up by rebooting. This started to happen more and more regularly and now it always happens if I hibernate. If I shut down completely, the computer is normally fine when I start it up again, although a couple of times the power lights come on and nothing happens, not even hard drive activity. Once Windows is up and running, there are no more error messages.
John Ioannou

A If the monitor switches to power-saving mode, it's because it hasn't received a valid video signal. A loose connection in the video cable can cause this, but that would just present as a random fault rather than something that only appears when booting up or resuming from hibernation.

We think the hibernation is a red herring as well. The only difference between resuming from hibernation and a cold boot is that the OS is loaded from a copy of your RAM that was saved to disk, instead of reloading and initialising everything from scratch. All the hardware starts in exactly the same way in either case. It looks as if your graphics card isn't booting on the first pass. Rebooting probably helps because the PC is warm booting, and the graphics card catches the reset signal and reinitialises correctly.

Etiquette demands that we remove and reinsert the graphics card in its slot to rule out a simple loose connection, but don't get your hopes up in this case. This probably won't be fixed by anything less than a new card. Since you currently have a GeForce 8800 GTX, you are long overdue an upgrade anyway.

CONNECTIVITY

SHARING RECEIVERS

Q I bought an Xbox 360 wireless controller to use with my PC. The Xbox 360 wireless pickup can accept up to four controllers per device/computer, so is it possible, rather than connecting a bunch of controllers, to connect a wireless keyboard and mouse via the 360 pickup? I already have a Logitech wireless keyboard and mouse combo, but I think this idea may help to keep a USB port open for future use.
James Smit

A Unfortunately, no. There's no standard protocol for the wireless communication used in keyboards, mice and controllers. Not only will Logitech and Microsoft products not interoperate, even devices from the same manufacturer might not work together unless they were specifically designed to do so and were bundled with a shared receiver.

Logitech uses four different wireless protocols that we're aware of and there might be others. Wireless keyboards and mice are frequently bundled together to share a single receiver, but we've never seen a controller and keyboard bundle. And even if such a thing did exist, all you're really saving is one USB port. Buy a four-port USB hub. APC

APCMAG@FUTURENET.COM Share your tech tips

Have you solved a tech problem or found a better way of doing things with your computer? Share your information with other *APC* readers by sending it in as a tip to apcmag@futurenet.com, together with your name and contact details (details won't be printed). Alternatively, if you have a technical question post it online on our forums at apcmag.com/forums and other readers may be able to solve it.

Desktop RAM disk roundup

Last issue we covered the benefits of using a RAM disk to boost your Steam games. But what about general usage and which RAM disk software meets your needs? Ashton Mills investigates.

YOU'LL NEED THIS

STEAM

If you're not already on Steam, the free 1.5MB download is available at **store.steampowered.com**.

SOFTPERFECT RAM DISK

Head to **www.softperfect.com/products/ramdisk** to download and install this high-performance RAM disk app.

As we covered last issue with our 'Supercharge your Steam games' guide (page 82), RAM disk software is nothing new on PCs, with even the venerable DOS sporting its own 'RAMDRIVE.SYS' driver back in the misty, ASCII-borne times of yore.

But they have certainly evolved. Where once they were simple enough to merely allocate a portion of memory as a virtual drive, today they come with a raft of features that include persistent images, using memory above the 4GB boundary on 32-bit Windows, and most interesting of all, dynamic allocation.

All of which make them eminently more useful, especially now that RAM is almost cheap as chips. If you've got 8GB or more of RAM lying around, consider putting it to use with one of these handy programs.

BENEFITS OF A RAM DRIVE

Generally, RAM drives are useful to accelerate read and write times for software, well beyond even the fastest SSDs or RAID configurations. A RAM drive is typically 20 times faster than even the fastest SSD, so if speed is important, nothing beats a RAM drive.

Beyond accelerating programs or games, they're also useful as scratch disks for apps like Photoshop, or as temp drives where programs (including Windows) can store miscellaneous temporary files. This is more useful than it sounds: for example, decompressiong a ZIP archive usually goes through Windows' 'TEMP' location first, which means something as simple as dealing with archives can be accelerated by a RAM drive.

There are a range of products available online, some paid and some free, but here's our selection of some of the more popular choices here.

SOFTPERFECT RAM DISK

www.softperfect.com/products/ramdisk

SoftPerfect's RAM disk is the only free product among our lineup and while it's not as pretty as its compatriots, does the job just fine. In fact, about the only feature missing we'd like to see is Romex Ramdisk's dynamic memory mode. The latest stable version is from November last year, although a very usable Beta is available from the forums and linked from the front page.

SoftPerfect's solution allows you to create multiple drives, use virtual or direct I/O emulation (the former being faster, but the latter allows the 'drive' to be recognised as physical by Windows), saving to image support (so you can save the contents of the image on shutdown and load them again at bootup) and support for compression when using NTFS to minimise RAM usage.

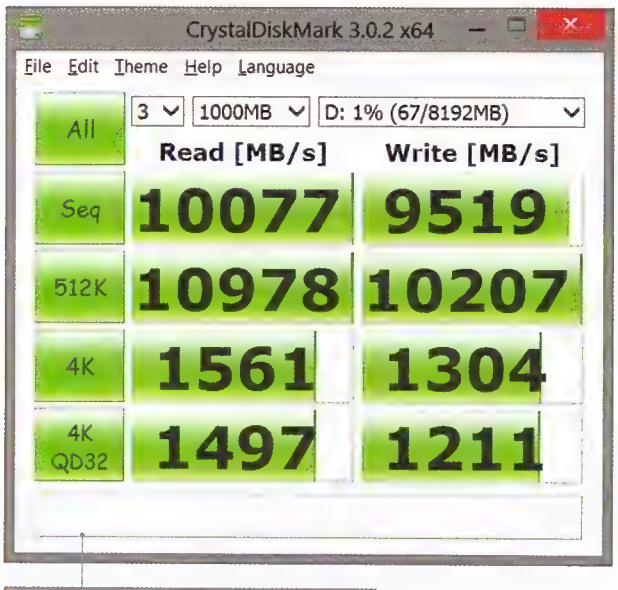
One nice feature is to periodically save the contents of the RAM drive to its image on disk, rather than just at shutdown, as with some other RAM drive tools. This is certainly a handy feature in case a system should crash or otherwise not shut down cleanly.

We chose SoftPerfect for last month's 'Supercharge your Steam games' guide because as far as free tools go, it does pretty much everything you need. However, there are more feature-rich alternatives available if you don't mind spending a little money.

SUPERSPEED RAMDISK

superspeed.com

SuperSpeed's product isn't quite as fully featured as Romex Ramdisk and costs a little more, with the standard version available for US$59.95 and the Plus version adding multiple disk, page file and image support for US$79.95.



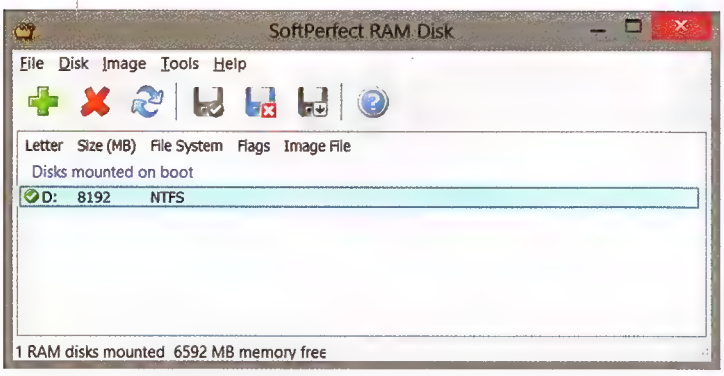
Even SSDs pale in comparison to RAM disk speeds – the technical term for these results is 'crazy fast'.

WHAT ABOUT LINUX?

Linux actually has two types of RAM disk built in. The first, ramfs, allows you to create virtual RAM disks under /dev of fixed size and need to be formatted with a file system (such as ext4), much like the RAM disks covered here. The alternative is tmpfs, a dynamically resizing RAM disk that can also swap out the system's swap file as needed (so it never runs out of space) and doesn't need to be formatted.

Typically, as its name states, this makes tmpfs ideal for temporary data and of course, the contents of a tmpfs file system will be lost when the system shuts down. However, you can create as many tmpfs instances as you like and most standard Linux installs allocate at least one tmpfs for the /tmp mount.

It's not quite as fully featured as other products here, but SoftPerfect does the job and it's free.


SoftPerfect RAM Disk
File Disk Image Tools Help
Letter Size (MB) File System Flags Image File
Disks mounted on boot
D: 8192 NTFS
1 RAM disks mounted 6592 MB memory free

Still, it includes all the essential features including saving the image to disk, NTFS compression and the ability to automatically create 'TEMP' folder entries for use with Windows' TEMP variable redirection. It also sports the unique ability to zero the memory regions used by a disk before unmounting it as an extra security measure, though this isn't something your average user needs to worry about.

Like Romex Ramdisk, it can also use memory regions above the 4GB boundary, enabling you to create RAM disks on systems with more than 4GB of memory running 32-bit Windows. It provides a fully functional trial period, albeit this is limited to 14 days.

On the whole, the SuperSpeed RamDisk does what it says, but unless the zeroing memory region feature appeals, the free SoftPerfect solution is just as suitable and free, while Romex Ramdisk provides more features at a lower cost. Still, it's good to have options.

ROMEX PRIMO RAMDISK II

www.romexsoftware.com

Romex is popular for its FancyCache (recently renamed to PrimoCache) disk cache and can dovetail with Primo Ramdisk if you so choose.

Coming in four versions from Standard to Server, all most people will really need for the desktop is the Standard or for RAM drives larger than 8GB, the Professional Edition. All come with a 30-day trial, after which the Standard edition costs US$29.95 while the Professional is US$49.95.

Primo Ramdisk sports a good interface and a number of useful features: you can create 'one-off' disks that operate only in the current session, make use of 'invisible' memory for 32-bit Windows systems (aka memory beyond 32-bit Windows' 4GB boundary), create 'hybrid' disks that span memory and physical media, as well as use its built-in tools to easily move Windows' TEMP and TMP variables to point to the RAM disk. The highlight, however, is its ability to create a dynamic RAM disk; that is, one that grows and shrinks according to its contents. This is arguably the best feature among the RAM disks covered here, as it allows you to create a large RAM disk without having that memory unavailable to the rest of the system until it's actually used. This is inherently ideal for RAM disks used as dumping grounds for Windows and application temp files.

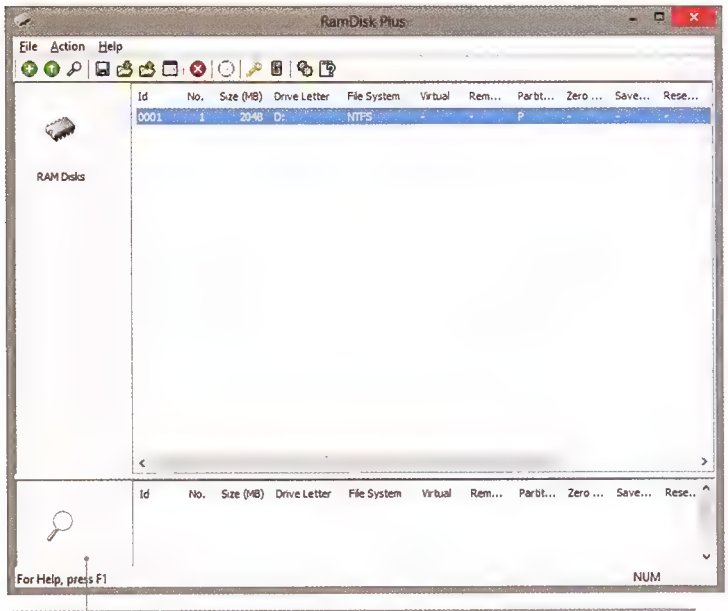
As with SoftPerfect and SuperSpeed's products, Primo Ramdisk can also load and save to image files to preserve the contents of a RAM drive, and supports both direct I/O and virtual drive modes. It's a little pricey when SoftPerfect offers most of the same functionality, although the dynamic memory usage support is a must-have for limited memory systems where you don't want a large chunk of your RAM commandeered by the RAM disk.

MOVING WINDOWS' TEMP

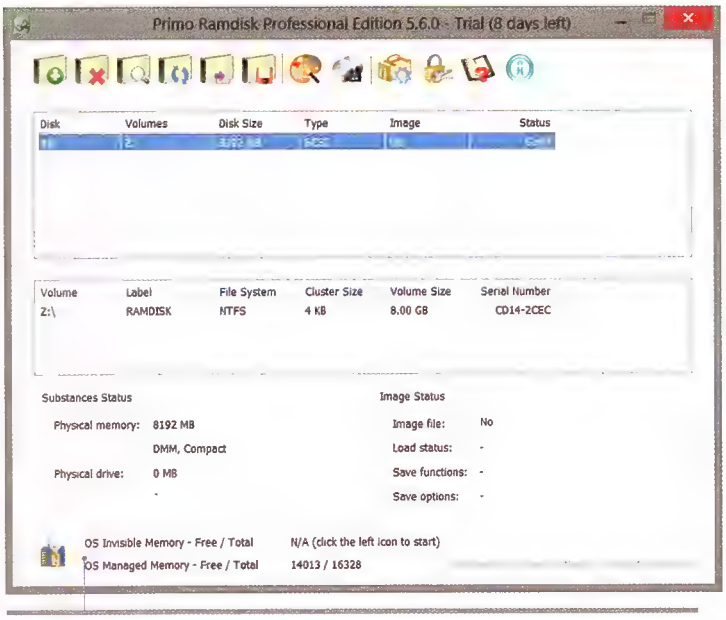
Anything requiring a temporary scratch space for Windows, from Windows itself to many of the applications you run, will use the location defined by the TEMP and TMP variables. By default, these point to 'Appdata\Local\Temp' under your username directory (C:\users\[*your username*]\). Naturally, by definition, anything stored in these directories is not worth keeping between reboots, so relocating these to your RAM disk not only reduces writes to your physical disks (useful to reduce wear if your OS is on an SSD), but a RAM disk is also considerably faster. Hence, moving TEMP and TMP to a RAM disk is a simple and effective tweak you can use to improve the performance of your system.

The only caveat is that if more space should be required than is available in your RAM disk, programs may fail. Romex has the advantage here, allowing you to create 'hybrid' RAM disks that first allocate to system memory and then to a physical disk when full, but large disks with NTFS compression can work here as well.

To manually redirect these after creating a RAM disk, open up 'Control Panel', launch 'System Settings' and click on 'Advanced System Settings'. Click on the 'Environment Variables' button at the bottom and you can edit the TEMP and TMP locations.



A capable and easy-to-use RAM disk, SuperSpeed RamDisk is a tad expensive compared to the competition.


Primo Ramdisk Professional Edition 5.6.0 - Trial (8 days left)
Disk Volumes Disk Size Type Image Status
Volume Label File System Cluster Size Volume Size Serial Number
Z:\ RAMDISK NTFS 4 KB 8.00 GB CD14-2CEC
Substances Status
Physical memory: 8192 MB
DMM, Compact
Physical drive: 0 MB
Image Status
Image file: No
Load status: -
Save functions: -
Save options: -
OS Invisible Memory - Free / Total N/A (click the left icon to start)
OS Managed Memory - Free / Total 14013 / 16328

Romex's product is more feature-rich than most, sporting the useful dynamic memory allocation.

GNOME: make it more useful

Andrew Gregory takes a leaf out of Linus's book and fixes GNOME with Frippery and some advanced settings.

YOU'LL NEED THIS

FRIPPERY
Download this from **extensions.gnome.org**.

GNOME TWEAK TOOL
Install this within Linux. The process varies depending on your distribution.

GNOME 3, it's fair to say, has divided opinions. With its sleek, swishy graphics it looks great. Apple has emulated its look with the Lion incarnation of Mac OS X, and all of its native applications hold to the same consistent user interface that made us love GNOME in the first place. And yet...

And yet the thing is that GNOME, by getting prettier, has been made less useful. In order to streamline its design to serve up a smooth touchscreen experience, GNOME has removed the 'Applications' menu and replaced it with the 'Activities' view (this is what you see when you move the mouse to the top-left of the screen). It's also taken functionality away from the Nautilus file manager (which Linux Mint, to its enormous credit, had been putting back in until it decided to fork its own file manager) and got rid of the shutdown option because, usage experts suggest, people who own tablets are apparently more likely to want to suspend and resume rather than power on and off.

If that all sounds as silly to you as it does to us, then welcome: we're going to use two tools that are endorsed by Linus Torvalds – Frippery and GNOME Tweak Tool – to reinstate the usefulness of GNOME, while retaining the lovely visual gloss of GNOME 3.

FRIPPERY

Frippery is the name given to a group of extensions for GNOME 3. There are RPMs available for Fedora versions 16-19 and Debs for Ubuntu 11.10-13.04, but the easiest way to get hold of the Frippery extensions is to visit **extensions.gnome.org**. Search the site for **frippery** and you'll get a list of extensions to GNOME 3, written by Ron Yorston for 'grumpy old stick in the muds'. That sounds like us. Installation via the web site is as easy as clicking on the name of the extension in the list and then toggling the 'On/Off' button in the top-left of the extension's page. You'll be asked if you want to download and install the extension, and as soon as it has done so, it will be available for use.

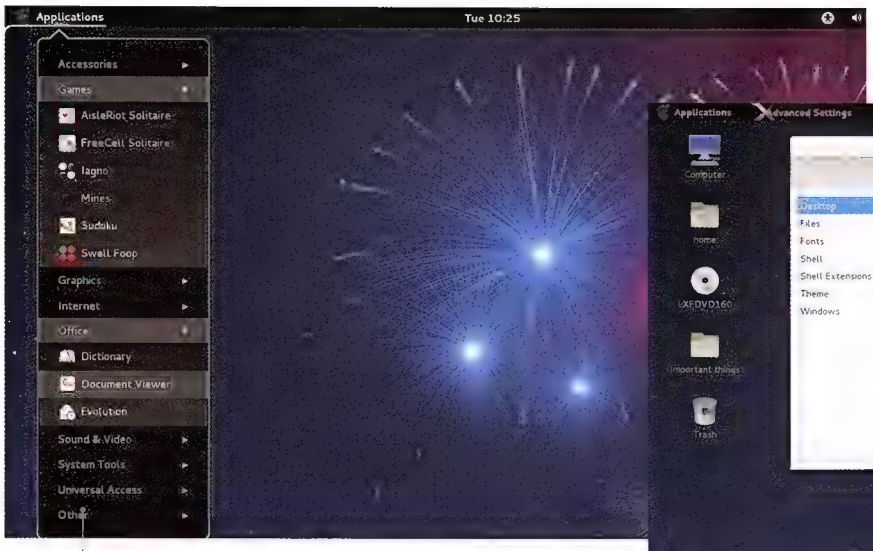
Some are more useful than others, but if you're using a version of GNOME 3 that doesn't have a 'Shut Down' button you'll probably want to add this extension; we've also gone for the 'Bottom Panel', which gives you an at-a-glance look at the application windows you have open; and the 'Frippery Applications' menu, which provides a drop-down list of the software installed on your system in a similar way to the GNOME 2 desktop. It enables you to look in more than one category at a time, but opens submenus within the same vertical column, with the result that if you try to look in every menu at the same time, some menu entries will be hidden. You'd be silly to use it this way. If you want to see all your software listed at once, you can use the hot corner to see all your app icons in the usual GNOME 3 way.

GNOME TWEAK TOOL

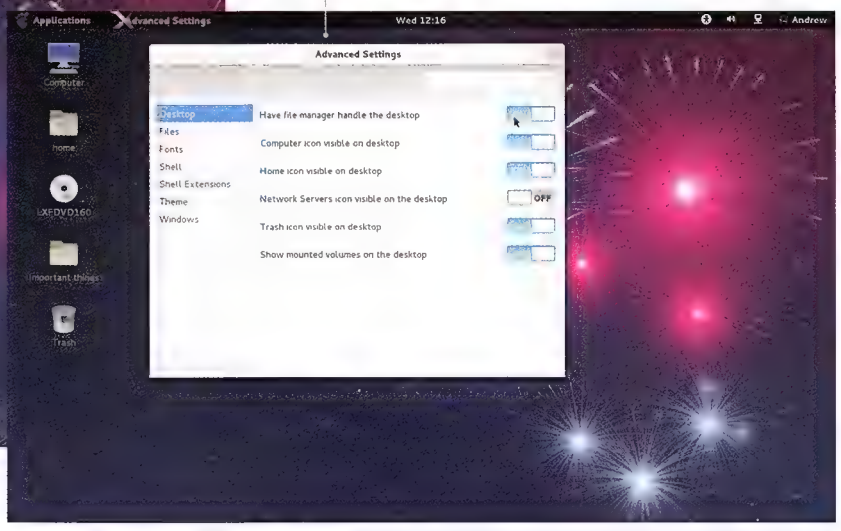
The GNOME Tweak Tool is available in Fedora via 'Add/remove software' and in the latest versions of both Ubuntu and Mint through Synaptic; however, as GNOME Tweak Tool is currently in Debian's 'Unstable' repository, you'll have to add this to your sources.list to install software from it. In Mint, this is as easy as opening up Synaptic, choosing 'Settings > Repositories' and ticking the 'Unstable Packages' box.

When it's installed, GNOME Tweak Tool goes by the name of 'Advanced Settings'. Let's get started with the 'Desktop' tab. If you change 'Have File Manager Handle The Desktop From Off to On', a bunch of icons will appear on the desktop; you'll also be able to create files and leave them visible on the desktop. This can get cluttered, which is probably why the GNOME developers disabled this feature by default, but many of us work quite happily with our current files on the desktop, tidying up occasionally when we finish the project we're working on. The other switches in this tab control exactly which icons appear – you can choose to have a 'Home' folder, but no 'Computer' or 'Trash' icons, for example.

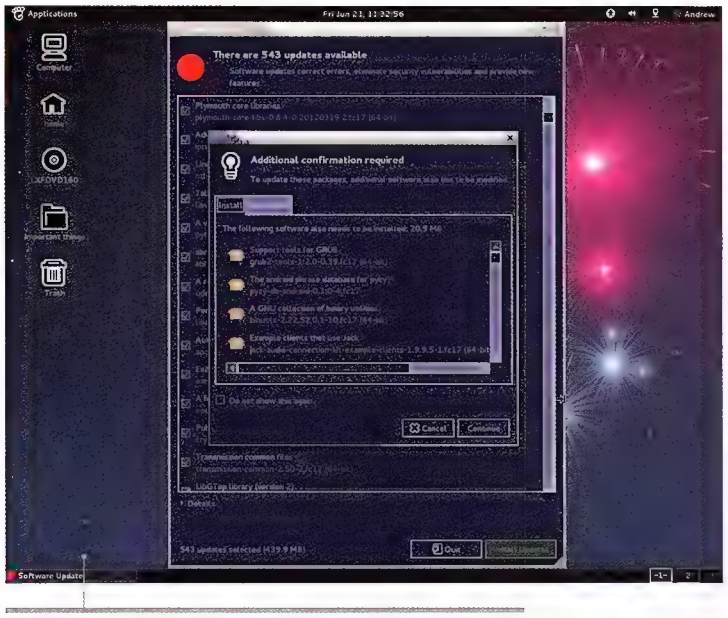
There's just one parameter to change in the 'Files' tab, which changes the location display in Nautilus, the file manager, from a breadcrumb-style path to a URL, displaying the location of directories like this: /home/AndrewF/Desktop/Stuff. The next tab, 'Fonts', may seem like a frivolous thing to be playing about with, but there may be valid reasons for wanting to change the appearance of text on the GNOME interface. One of these is that IT managers may want to ensure a consistent look across all branding elements of an organisation. Also, if your eyesight is beginning to go or if you stare at a computer screen for eight hours a day and want something a little easier on the eye when you boot up your home computer, a larger, thicker font could be a boon.



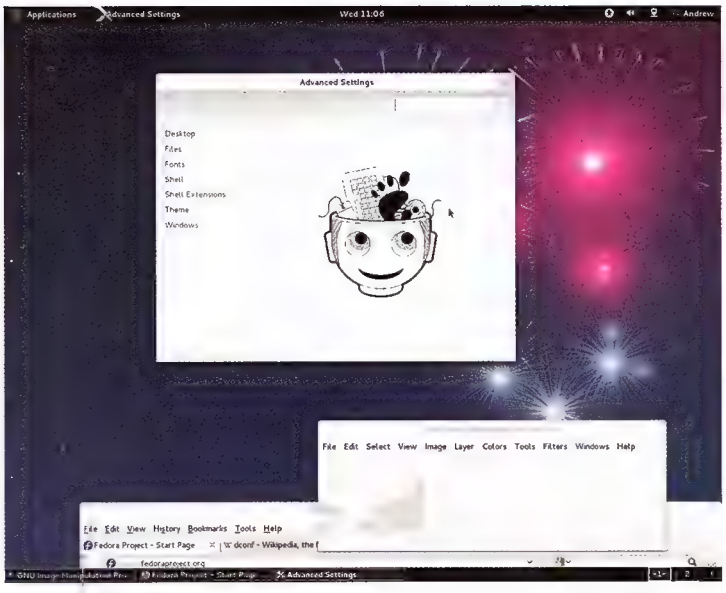
The Frippery 'Applications Menu' is ideal when you know what an app does, but not what it's called.



Displaying 'Computer', 'Home', 'Trash' and mounted volumes icons on the desktop ruins the minimalism, but adds to the UI's usefulness.



High-contrast (inverse) icons and GTK theme, plus Ye Olde Crux window theme, create a retro-looking desktop.



Look – a bottom panel, showing minimised app windows!

'Shell', the next tab, feels like a mixed bag of options that are only clustered together because they wouldn't fit anywhere else. It's here that you can add the date and a seconds counter to the clock, for example, and also reinstate the minimise and maximise buttons that were removed by the GNOME 3 developers in the name of creating a streamlined, touchscreen-friendly interface. If you're still stuck in the dark ages of using a keyboard and a mouse to get information into the computer (like most people), it's a good idea to add maximise and minimise buttons.

CUSTOMISE BEHAVIOUR

You also get the chance to set the way the operating system behaves when the laptop lid closes (if you're using a laptop, that is) and to choose between dynamic or a set number of workspaces. The default, at least in Fedora's implementation of GNOME 3, is to have dynamic workspaces, so you always have the virtual desktop you're working on +1. 'Shell Extensions' provides a way to manage any extensions that you've installed. In our case, have the three Frippery extensions that we installed earlier.

The 'Theme' tab will be familiar to anyone who's ever played with the old GNOME themes. The 'Window Themes' just provide aesthetic gloss, although the 'Icon' and 'GTK' themes give you the highly useful high- and low-contrast modes. If your eyes are going dim, you may want to try the high-contrast options for these settings, as the black on white (or white on dark blue) colours they give are easy to pick out. If you have eye strain from staring at the glowing box for eight hours a day, low contrast might be better, as this turns everything into muted greys and beiges.

The last of GNOME Tweak Tool's options, 'Windows', defines the behaviour of individual windows when certain actions are performed. As we tend to keep a lot of files on the desktop, we find it convenient to be able to quickly minimise a window to the panel – with the 'Frippery' panel enabled, we can do just that, by changing the 'Action On Title Bar Double-Click' from 'Toggle Maximize' to 'Minimize'.

And there we have it: the same GNOME 3 desktop, tweaked slightly to make it more useful. Not to make it better for a touchscreen or to impress anyone looking over our shoulder, but to make it better for day-to-day work.

Make the best of OS X's built-in security

Before you decide whether or not to add third-party security software to your Mac, figure out if what's already there is enough for you. Matthew J.C. Powell shows you how.

YOU'LL NEED THIS

BUILT-IN PROTECTION

Mac OS X features a number of build-in security tools to protect your computer from nasties. We'll outline a number of these options in this article.

As you probably know by now, the Mac isn't immune to attack from malicious software. If you don't know yet, read carefully: the Mac isn't immune to attack from malicious software. The myth that Apple fanbois (and to an extent, Apple itself) perpetuated for years – that malware was something only Windows users needed to worry about – is and always was just that: a myth.

That doesn't mean you need to panic, though, as Apple has also been gradually stepping up its efforts to secure the OS. It's been quiet about it, though – Apple just doesn't seem to like talking about security, lest people get skittish.

For one thing, you may not be aware that OS X already includes built-in malware detection software. If you're running OS X 10.6 (Snow Leopard) or later, your Mac has a bit of software called File Quarantine (popularly known as XProtect) running in the background, checking almost every file that comes into your Mac against its database of malware signatures. These signatures are updated periodically and it currently identifies RSPlug, iServices, HellRTC, OSX.OpinionSpy and MacDefender malware.

When you download a file via sanctioned means, such as a web browser, Mail or Messages, XProtect checks it first to see if it contains any executable code and then checks that against its signature database. If it recognises something malicious, it will refuse to open the file and will advise you to put it in the trash. If it recognises an executable, but not a malicious signature, it will throw up a dialogue asking if you're sure you want to open it. If you think it's an image or video file and XProtect says it's an application, don't open it.

What it doesn't do is look at every possible avenue of installing files on your machine. If you download things via BitTorrent, for example, you're on your own. Most mainstream browsers support it, but if you use something other than Safari, Chrome, Firefox or Opera, you may not be protected.

It also doesn't remove malware or 'clean' infected files (despite its Wikipedia entry calling it 'spyware removal software' – it isn't) and it recognises only Mac malware, not Windows. So if you get an email infected with a Windows virus and you pass it on to a Windows-using friend, they'll get infected, even if you don't.

If you deal with Windows users a lot or if you download files via non-traditional avenues, you may want to look at a third-party antivirus tool.

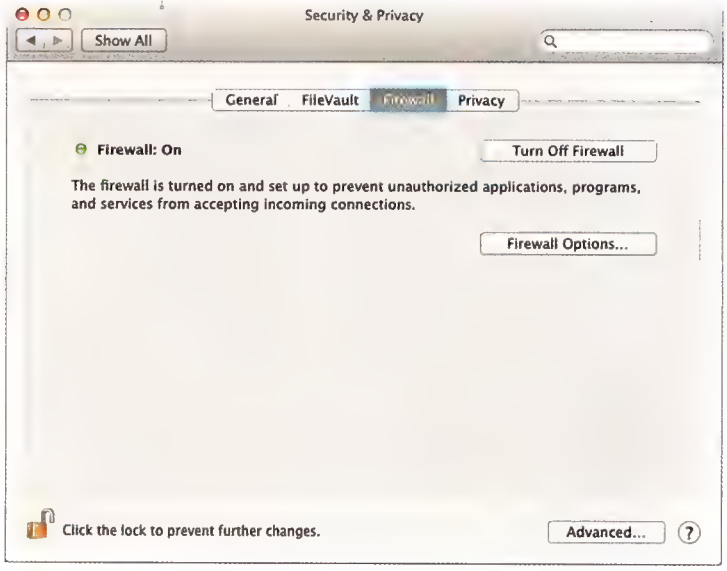
BUILD A WALL

As well as its (limited) antimalware protection, OS X has not one, but two firewalls built in to keep the nasties out. The first is the port filter, built into all Unix systems. Up to OS X 10.7, this was called ipfw, but ipfw has since been replaced by pfctl.

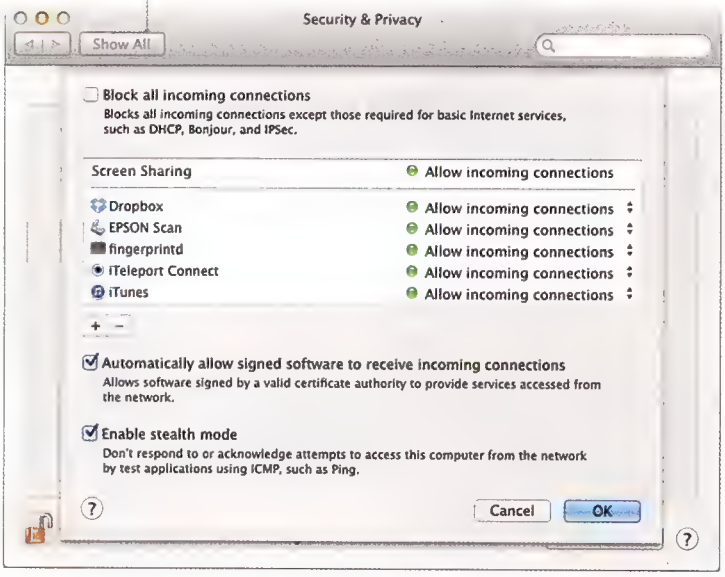
If you're already intimidated, don't be. You need never have anything to do with pfctl if you don't want to (and if you do, go to the Terminal and type `man pfctl` to find out all about it).

OS X also includes what's called an application firewall, which monitors traffic based not on what port it's using, but on the application using it. And to configure that, you don't need the Terminal at all. Simply open up 'System Preferences' and click on 'Security & Privacy'. You'll notice that the third tab from the left is called 'Firewall' – click on it. If you're then told that the firewall is turned off, turn it on. You may have to authenticate yourself with an admin password.

OS X's application firewall isn't overly sophisticated, but it's adequate for most users.



You can tell the firewall which applications to allow through and which to block. Blocking everything will stop you doing certain things with your Mac, though.

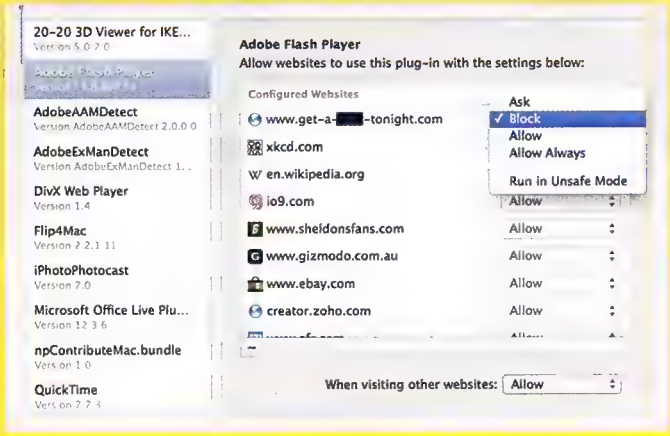

Security & Privacy
Show All
Block all incoming connections
Blocks all incoming connections except those required for basic Internet services, such as DHCP, Bonjour, and IPSec.
Screen Sharing
Allow incoming connections
Dropbox
EPSON Scan
fingerprintd
iTeleport Connect
iTunes
Allow incoming connections
Automatically allow signed software to receive incoming connections
Allows software signed by a valid certificate authority to provide services accessed from the network.
Enable stealth mode
Don't respond to or acknowledge attempts to access this computer from the network by test applications using ICMP, such as Ping.
Cancel
OK
?

SAFER BROWSING

APPLE'S SAFARI WEB BROWSER INCLUDES A NUMBER OF FEATURES DESIGNED TO IMPROVE YOUR SAFETY ONLINE, IF YOU KNOW HOW TO USE THEM PROPERLY.

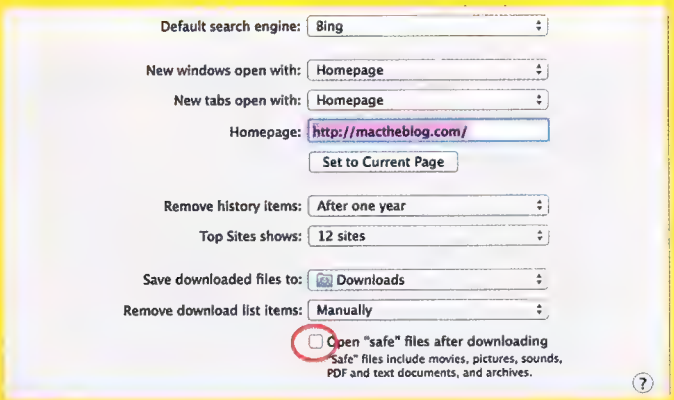
In Safari, open 'Preferences' (from the 'Safari' menu) and click on the 'Security' tab. Make sure 'Warn when visiting a fraudulent website' is ticked. While not as sophisticated as dedicated antiphishing tools like Norton Internet Security, this will catch most fake web sites that have been designed to steal your personal information.

It's also a good idea to untick 'Enable JavaScript' just because it's been known to be used as a way to attack Macs. If you know you require it, of course, go ahead and enable JavaScript. But if you don't, you might as well shut that door.



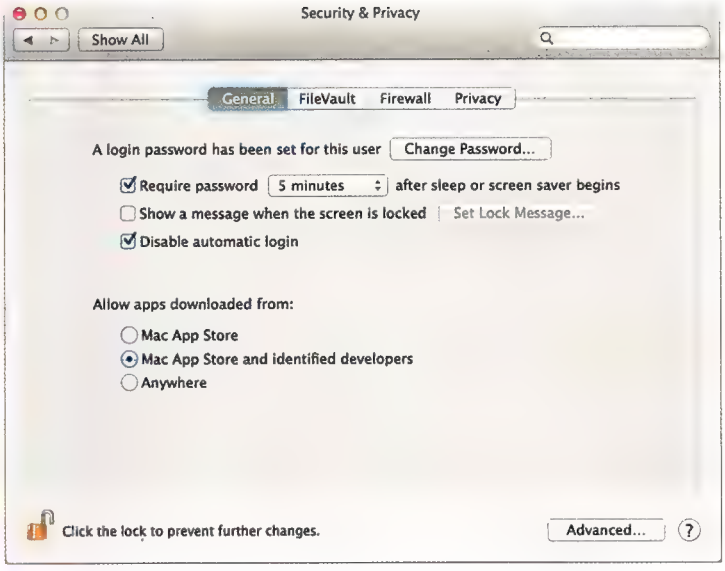
Below the 'Enable JavaScript' setting, you'll see the option to allow (or not) the use of plug-ins. While the ultimate secure web browser wouldn't allow plug-ins, they do come in handy. One in particular is both a gift and a curse: Flash.

Click on 'Manage Website Settings' and you can see all the plug-ins you have installed and all the sites you've visited – knowingly or not – that used them. You can remove plug-ins you don't like the look of or configure whether you want to allow them on individual sites.


Default search engine: Bing
New windows open with: Homepage
New tabs open with: Homepage
Homepage: http://mactheblog.com/
Set to Current Page
Remove history items: After one year
Top Sites shows: 12 sites
Save downloaded files to: Downloads
Remove download list items: Manually
Open "safe" files after downloading
"Safe" files include movies, pictures, sounds, PDF and text documents, and archives.

And finally, there's the setting that shouldn't even be there. Early versions of Safari would automatically open files you downloaded. That's very convenient, but not very secure. Then the option to tell Safari not to do that was added, but it was left on by default. In recent versions, this setting is off by default.

If you want to be the one who decides what files open on your Mac and what files don't, make sure it stays off.



One way to keep nasties out of your Mac is to make sure you only install software from places you trust – or at least that Apple trusts.

Next, click on the button for 'Firewall Options'. At the top of the following dialogue, you'll see the option to 'Block all incoming connections'. Unless you're very paranoid, we don't recommend doing that. It leaves you with very barebones access to the internet and to services on your home network – iTunes Home Sharing won't work, for instance, if you activate that.

Below that option you'll see a list of the applications that have been using ports on your computer. If you see any there that you don't recognise, click on where it says 'Allow incoming connections' and from the pull-down menu, select 'Block incoming connections'. If you find that doing so adversely affects some service that you use, come back later and open it again.

If you add software to your Mac that requires access to open ports, you can add it to the list manually by clicking on the '+' (plus) sign and selecting it.

You can save yourself some hassle, though, simply by selecting 'Automatically allow signed software to receive incoming connections', which is the next option down. This works hand in hand with Gatekeeper (we'll get to that in a minute) and basically extends the system's 'trust' of a given application to allow it to communicate with the outside world. If your Gatekeeper settings allow only trusted applications to install, then this option is safe as well.

Finally, there's 'Stealth' mode. The best way to avoid a malicious attack on your computer is if the outside world can't see it at all. In Stealth mode, that's exactly what happens. Any remote machine that sends a ping to your Mac (at least, to most ports on your Mac) gets no response at all – not a report that the port is closed or open or in use, just nothing at all.

SHUT THE GATE

Then there's Gatekeeper. As we mentioned in last month's security feature (see page 74), Gatekeeper is the system OS X uses to reduce the risk of malicious software being installed on your computer. It's under the 'General' tab in the 'Security & Privacy' pane in 'System Preferences'.

At its narrowest, Gatekeeper will only allow software purchased from the Mac App Store to be installed – much like the way an iPad works. Of course, not all software vendors (including Adobe and Microsoft) sell their software through the App Store, so you can allow software from the App Store and 'identified developers' to be installed. These developers have obtained certificates from Apple and 'sign' their installers for Gatekeeper to recognise them.

The same signatures are used by the Mac's application firewall to let it know it's safe to allow those applications to communicate with the outside world.

Downgrade iOS apps

If you've updated an iPad app and discovered the new version is broken, don't despair. Matthew J.C. Powell shows you how to get the old version back.

YOU'LL NEED THIS

A PC OR MAC

Whichever machine you use to regularly sync your iOS device.

ITUNES

Of course, your computer needs to have iTunes installed to sync with your iOS device.

If you have a lot of apps installed on your iOS device, you probably receive a lot of notifications telling you there are updates available – three or four a day, maybe even more. You might, just to make them go away, open the App Store and tap 'Update All' without actually reading the developers' descriptions or any reviews of the new version first. For the most part, that's fine because problems are rare.

But not unknown.

For instance, you may find that the developer, in order to fix a particular bug, has temporarily disabled a feature that you use all the time in an app (a recent update to Readdle's Documents app dropped support for iCloud, for example). That would probably have been flagged (as it was in Readdle's case) in the description, with an all caps warning: 'DON'T UPDATE IF YOU USE ICLOUD', but you didn't read it.

Oops.

Or as many players of FireMonkeys/EA's *Real Racing 3* have found, the developer may have tweaked the gameplay a bit so that it's no longer to your liking. You'd know if you read the reviews, but you didn't.

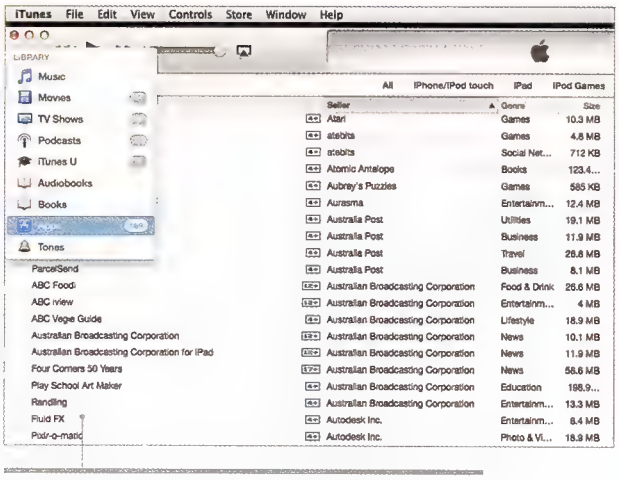
Oops.

Or hey, maybe the update's just got a bug in it. That happens, too.

Whatever the reason, you don't need to feel like you're stranded with a broken app if the older version worked fine. Here's how to turn back time (in this limited context).

FIRST, TO THE MAC!

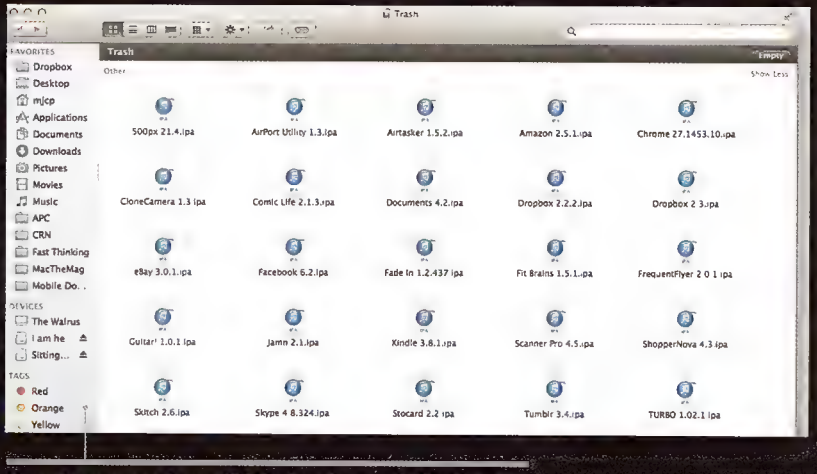
For this tutorial, we're assuming that you regularly sync your iOS device to a computer – either Windows or Mac, though these instructions will be Mac-specific. Even if you download updates directly to your device rather than to your computer, the important thing is that the apps eventually find their way on to a machine with a file system you can poke around in.



All of the apps you've downloaded from the App Store – even the ones no longer on your device – are listed in iTunes under the 'Apps' tab.

In your iTunes library, click on the tab to show your collection of apps. If need be, click on the 'List' tab, which makes it easier to find the particular app you're looking for. Either scroll through the list to find the app or type its name into the 'Search' field in the upper-right of the screen.

When you've found it, right-click on it (or two-finger tap, if you're a trackpad user) and select 'Show in Finder' from the pop-down menu (Windows users choose 'Show in Explorer'). Your 'Mobile Applications' folder will then open, with the app you're trying to downgrade selected. It will have the file extension .IPA and in most cases, the version number will be part of the filename as well. See the 'Look up the number'



If you have synced your iOS device since updating the app, don't despair. The old version of it may well linger in the Trash – if you haven't emptied it yet.

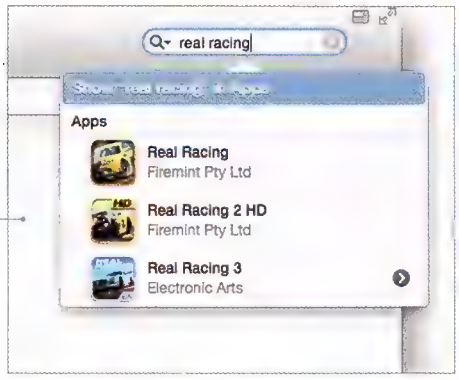
EVEN OLDER VERSIONS

What if it turns out you've synced to your Mac already before discovering that the update didn't meet your needs? The updated version of the app will be there in your iTunes library, so what can you do?

Well, if you're like a lot of people these days, you're probably not as diligent about emptying your Trash as you might be. With multiple-terabyte hard drives commonplace, it's easy to forget when you're in no danger of running out of space.

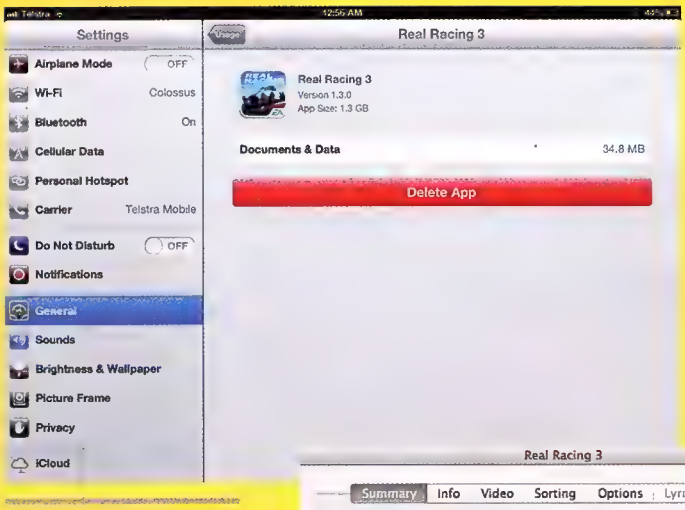
Good housekeeping it may not be, but a lifesaver it may well. Open your Trash and you'll more than likely find many, many, many files with .IPA extensions. These are the old versions of iOS apps that you've updated. When you update an app, the old version isn't overwritten, as with most desktop applications – it's just shifted to the Trash to await emptying.

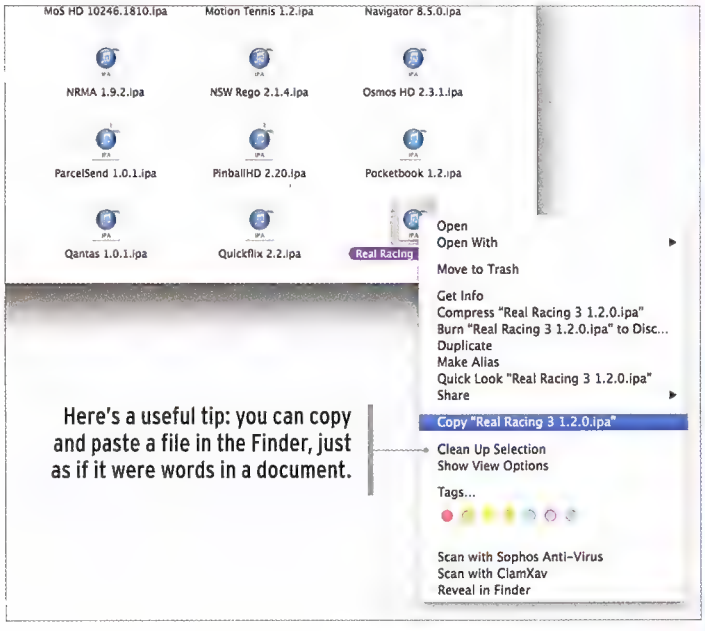
So if you're lax about emptying the Trash (or the Recycle Bin) on your computer, you may yet be able to find the previous version of your app and put it back onto your iOS device.



Rather than scroll through the list of downloaded apps to find the one you want, just type its name.

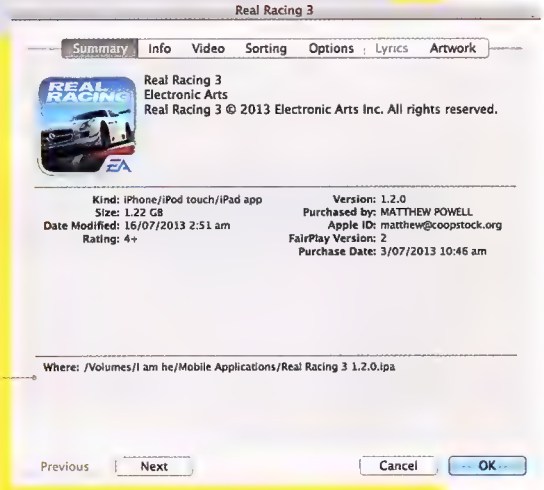
You can see how much space each of your apps is taking up on your device by checking in the Settings app.





Here's a useful tip: you can copy and paste a file in the Finder, just as if it were words in a document.

Clicking on the arrow next to an app gives a little bit of extra info, but not much. It does provide an extra 'hidden' method of deleting apps, though – if you don't like the wiggle thing.



Get Info on an app in iTunes and you can get quite a bit of background on it that you can't find directly from your iOS device.

box for more information on making sure that you're downgrading to the version you want.

Next, copy the file (right-click again), create a new folder on your desktop and paste it in. Don't drag and drop it because you don't actually want to move it from its present location. It's a good idea, just to be safe, to change the extension on the pasted copy to .BKP (short for 'backup') or something similar, just so that it isn't accidentally overwritten. You'll get a dialogue box warning you not to do that because of the dire consequences that may befall you – ignore it.

Next, sync your iOS device. This will place the updated, newer version of the app in your 'Mobile Applications' folder. Once it's there, you can delete it. Just right-click it, select 'Delete' and when you're prompted, click 'OK'.

Next, you need to delete it from your iOS device. Just tap and hold on the icon until it wiggles and then tap the X in the corner.

NOW, RESTORE

Go back to the .BKP version of the file you created and change its extension back to .IPA. Right-click it again, select 'Open With' and choose the default, iTunes. The file will then be added back into your iTunes library.

Next, sync your iOS device again. Go into the 'Apps' tab when the device is connected and ensure that the app you're trying to downgrade is selected to be synced to the device.

Once that's done, you should be happily up and running with the previous version of the app. You can either wait for a non-buggy, fully functioning update from the developer or continue happily using an app that works for you.

Just remember to look before you update next time.

LOOK UP THE NUMBER

How can you be sure the app you're restoring is older than the one you're deleting? There's no point doing all of this if you're just going to end up with the same unwanted update.

First, go to the Settings app on your iOS device. Tap 'General' and then 'Usage'. After a moment's buzzing and whirring, you'll see a list of the apps installed on your device, in descending order of size. If you don't see the one you're after, tap on 'Show all Apps' to see the full list.

When you find the app you want to downgrade, tap on the arrow to the right to find out its version number.

On your Mac or Windows machine, you'll almost always see the version number in the filename. If not, right-click it in iTunes and select 'Get Info' from the drop-down menu. Click on the 'Summary' tab and you'll see all sorts of useful stuff, including the version number.

Speed up your lagging Nexus 7 (or other device)

Has your device become noticeably laggier over time? Help is here, thanks to Simon Chester.

YOU'LL NEED THIS

LAGFIX

Get the free version of LagFix from **tinyurl.com/c8ojlcn**.

DISKUSAGE

Download and install the app from the Google Play store at **tinyurl.com/bzsu9fk**.

ROM MANAGER

The free version is available at **tinyurl.com/7sl2n9x**. The paid version costs $5.99.

When it launched, the original Nexus 7 was a landmark device. It was the first of the budget tablets that actually delivered a premium experience and the 7-inch form factor made it the perfect bridge between phones and tablets, making it both a pleasure to interact with, while remaining (jacket) pocketable. However, just over one year on and people are complaining that it's become slow to the point of unusable.

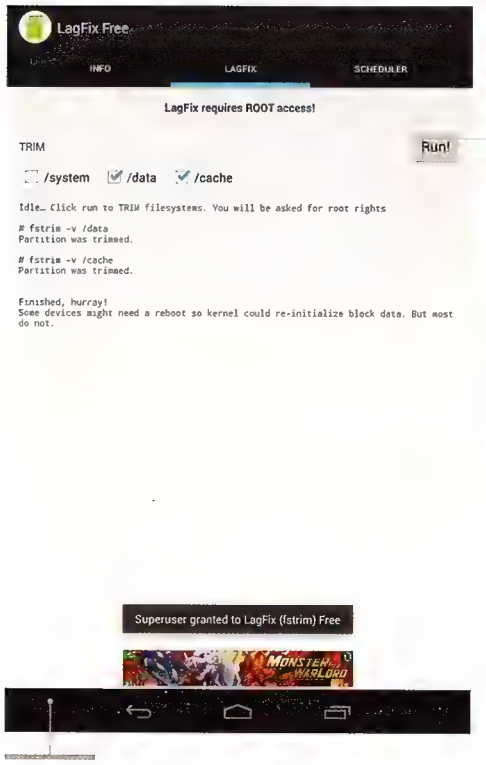
"Surely," you ask, "it's just our perceptions that have changed – the CPU certainly hasn't become any slower!" You are partly correct – the CPU is still zipping along at 1.21 jiggawatts (or something like that), but something else has changed: the flash storage has become cluttered. In fact, this problem isn't isolated to the Nexus 7 – there are reports that the Nexus S, Galaxy Nexus, Nexus 4, Nexus 10 and HTC One X all suffer from slowdown over time. Other models may also be affected, so if you're having lag problems that never used to exist, read on.

Being the learned reader of *APC* that you are, we can assume you're aware that the minimum amount of data that can be erased from NAND flash memory (known as a block – typically 512KB) is actually larger than the minimum amount of data that can be written to flash (known as a page – typically 4KB). Further to this, NAND flash memory cells can only be written to if they are empty.

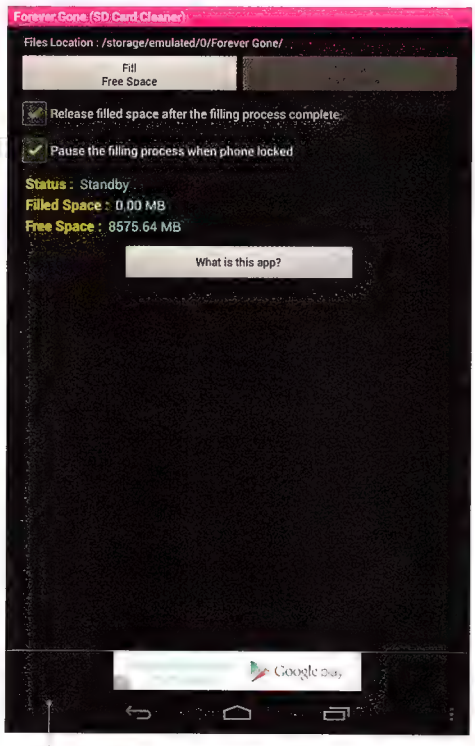
This means that if less than one block of data needs to be written, the entire block needs to be copied to memory and its spot on the disk erased, before being copied back to NAND along with the new pages of data. To avoid this occurring too often, blank blocks are prioritised over those containing pages of data, but as your device fills up over time, blank blocks become less common and this copy/erase/paste process has to occur more and more often, which manifests itself as lag.

On almost all operating systems, when data is deleted it's just marked in the file system as being OK to overwrite, rather than being erased. Operating systems don't communicate this information to storage devices, so the device doesn't know which pages of data within a block have been 'deleted' by the file system until it's told to overwrite them, which then triggers the laggy copy/erase/paste shuffle outlined above.

One technology invented to mitigate this progressive introduction of lag was TRIM. TRIM is a method implemented at the OS level that tells the flash storage device what data has been deleted so it can execute background garbage collection routines that erase deleted data from their pages, readying them for immediate writing. These routines also prevent 'deleted' data from being shifted around, therefore increasing the drive's life expectancy (NAND flash can only be written and erased a finite amount of times).

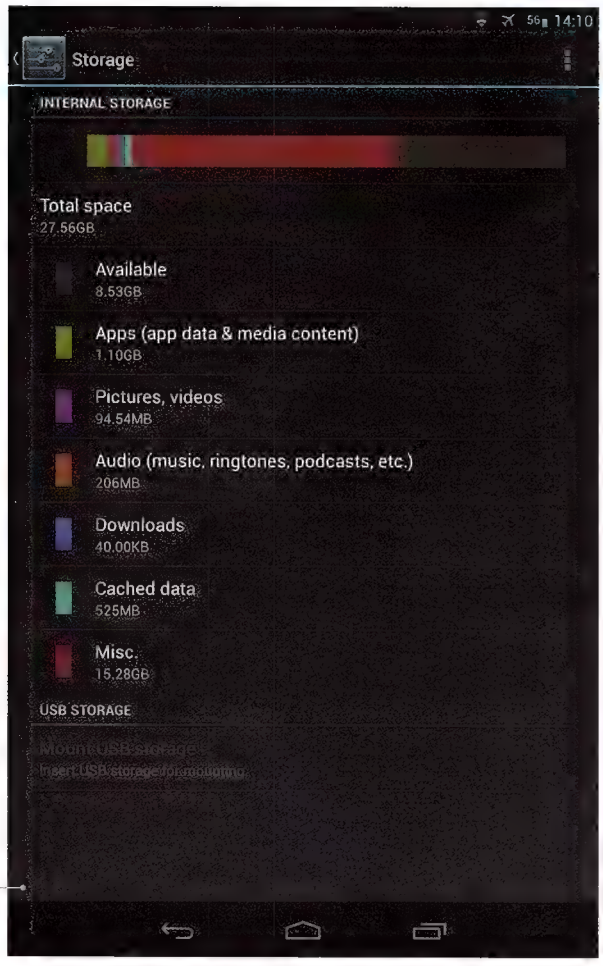


LagFix runs the TRIM command for you, so it's easy to restore your device back to its former glory.

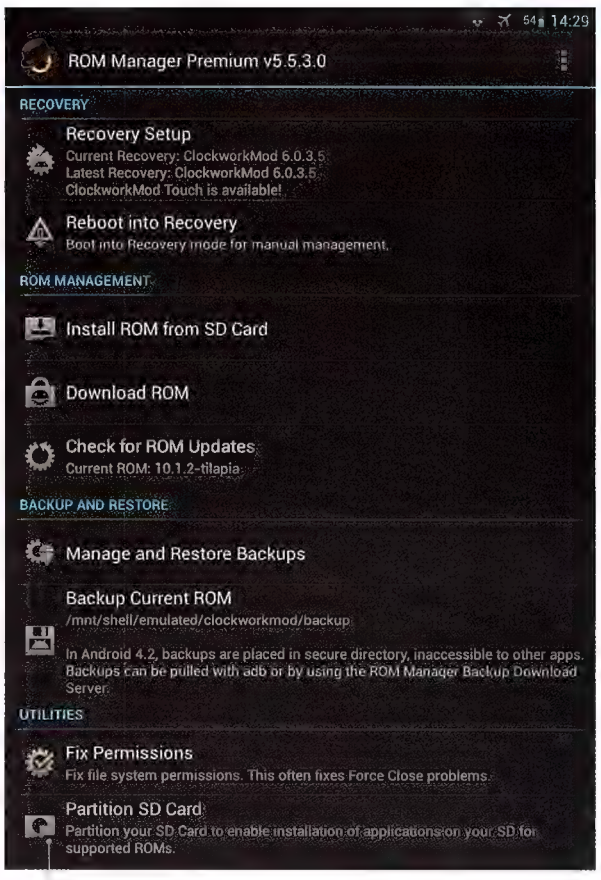

Forever Gone (SD Card Cleaner)
Files Location : /storage/emulated/0/Forever Gone/
Fill
Free Space
Release filled space after the filling process complete
Pause the filling process when phone locked
Status : Standby
Filled Space : 0.00 MB
Free Space : 8575.64 MB
What is this app?

Forever Gone makes it difficult for file recovery apps to get deleted data off of your device.

The free DiskUsage app shows how much storage you have left and where that storage has gone.



You should aim to keep at least 25% of your device's storage free.


14:29
ROM Manager Premium v5.5.3.0
RECOVERY
Recovery Setup
Current Recovery: ClockworkMod 6.0.3.5
Latest Recovery: ClockworkMod 6.0.3.5
ClockworkMod Touch is available!
Reboot into Recovery
Boot into Recovery mode for manual management.
ROM MANAGEMENT
Install ROM from SD Card
Download ROM
Check for ROM Updates
Current ROM: 10.1.2-tilapia
BACKUP AND RESTORE
Manage and Restore Backups
Backup Current ROM
/mnt/shell/emulated/clockworkmod/backup
In Android 4.2, backups are placed in secure directory, inaccessible to other apps. Backups can be pulled with adb or by using the ROM Manager Backup Download Server.
UTILITIES
Fix Permissions
Fix file system permissions. This often fixes Force Close problems.
Partition SD Card
Partition your SD Card to enable installation of applications on your SD for supported ROMs.

The easiest way to back up your device is to install ROM Manager by ClockworkMod.

For reasons beyond us, however, Android didn't introduce TRIM until version 4.3 (see **tinyurl.com/mfe3ahn** for more information), so to fix the slowdown experienced by frustrated Android owners, you need to take matters into your own hands. We've outlined five possible solutions to this problem in preferential order.

OPTION 1: UPGRADE TO ANDROID 4.3

Android 4.3 supports TRIM commands and installing it on your device will make the problem disappear. For Nexus users, the update should have been pushed onto you in early August, but if you're running a custom ROM or have a device other than a Nexus, check to see if there's an update available online. If not, or you're rather attached to an earlier Android version, you can always try option 2.

OPTION 2: RUN LAGFIX

XDA Developers user AuxLV has developed an app, LagFix, that runs the TRIM command for you, so it should be easy to restore your device back to its former glory. If you fork out for the paid version (around $2), you can even schedule the TRIM command to run; if you're happy with ads and don't mind manually running the app weekly, the free version should do you fine. Note that the app is only compatible with specific devices and certain devices can be irrevocably destroyed by running it, so make sure you read the FAQ at **tinyurl.com/ltsr8pu**. The app requires root access, so if you're not rooted or you have an unsupported device, try option 3.

OPTION 3: RUN FOREVER GONE

Forever Gone's primary purpose is to make it harder for file recovery apps to get deleted data off of your device. It does this by filling any remaining space on your device with blank files and then deleting them. This 'resets' all the blocks on your device so it will remove the lag. As it's writing to your entire device, it isn't as elegant as LagFix and causes some wear on your SSD, so we don't recommend running it regularly. For an unrooted Android 4.2 or lower device, it may be your be best bet.

OPTION 4: FREE SOME SPACE.

The issues caused by the lack of TRIM support become much worse when the storage fills up. As a workaround, you should delete any old movies, apps or other large files that you can live without. You should aim to keep at least 25% of your storage free. The best way to find out how much storage you have left and where that storage has gone is to either install the free DiskUsage app by Ivan Volosyuk, or simply go to 'Settings > Storage'.

OPTION 5: BACKUP, FORMAT, RESTORE.

The most extreme (and least recommended) solution to this problem is to back up, wipe and restore your device. This is a lot easier with a rooted device, as you can run a ClockworkMod backup, which takes a complete snapshot of your device, apart from your personal files, so don't erase those unless you've backed them up manually. The easiest way to do this is to install ROM Manager by ClockworkMod – just look for the 'Backup Custom ROM' button within the app.

It shouldn't be necessary to format the partition that contains your personal files because the lag is really caused when writing to the system partition. Therefore, after the backup is done, just open up ROM Manager, go to 'Manage and Restore Backups' and restore the backup you just made.

If your device isn't rooted, Google does a pretty good job of keeping your info backed up in the cloud (if you enabled it when you set up your tablet, or under 'Settings > Backup & Reset'), so your apps, Wi-Fi passwords and other data will return after you set up your tablet. Note that app settings may or may not appear, though, as each app developer has to support Google's cloud backup. To factory reset your device, just go to 'System Settings > Backup & reset > Factory data reset'.

Between these five options, you should be able to restore your device to its initial super-speedy, sexy, smooth state. And with Android 4.3 now supporting TRIM, these problems with lag should now be a thing of the past.

Fix PC problems with the Event Viewer

Find and eradicate the sources of those nagging PC issues with our handy guide.

YOU'LL NEED THIS

WINDOWS

The Event Viewer is built into the operating system. It doesn't require any setting up, but the tool is quite expansive and you need to spend some time with it to really use it to your advantage.

The Windows Task Manager is a wonderful tool for handling misbehaving applications and wayward processes. While clipping the errant task might allow you to continue using the PC, you're still left with the job of tracking down and troubleshooting the problem that caused the process to misbehave in the first place.

This might sound like a daunting task, but this is where the Windows Event Viewer excels. The Event Viewer acts as a log for various applications and Windows components. You can open Event Viewer by pressing Windows key+X and then clicking 'Event Viewer'.

At first glance the Event Viewer might look intimidating, even to power users. It uses a three-pane interface that was introduced with Windows Vista and subsequent versions of Windows have refined this layout. In the left pane you have an expandable tree that provides easy access to all of the Event Viewer's logs. The two main categories are 'Windows Logs' and 'Applications and Services Logs'. The 'Windows Logs' category includes the 'Application', 'Security' and 'System' logs, while 'Applications and Services Logs' stores events from individual applications.

CAPTURING EVENTS

Windows starts recording events the moment the PC is first set up, so the Event Viewer will have hundreds of entries. Windows 8 also adds events to the log every time it installs or uninstalls an app. Of course, this might deter novices, but is very useful information in the hands of a power user.

When browsing the logs, remember that these are listed in reverse chronological order, with the most recent events at the top. In the centre is the 'View' pane, which displays both the list of events and the information that each event contains. On the right-hand side of the Event Viewer is the 'Actions' pane, which contains a list of actions associated with the Event Viewer, such as the option to create a custom view to filter events you need to monitor regularly (see the step-by-step guide opposite).

Before you can really use the Event Viewer to diagnose issues, however, you must first understand the types of events it records and the information it captures alongside these events.

Start by scrolling through 'Administrative Events', which primarily lists error messages. This should be the first place you visit when something goes wrong because entries here represent serious problems with Windows, the network, attached hard disks, installed applications and so on.

Next, browse through the 'Windows Logs' category. It contains different folders, such as 'Application', 'Security' and 'System', each of which is devoted to a specific type of event. The 'Application' folder tracks events such as errors with Windows and other third-party software. The 'Security' folder mostly contains information about login attempts. This information comes in handy for detecting unauthorised login attempts when your computer is left unattended.

If you have trouble installing an app, simply browse the entries in the 'Setup' folder. It lists error codes and other information to help you successfully install a program or app. The 'System' folder lists errors and information about critical Windows services, drivers and your network connection.

FINDING ERRORS

If you're trying to solve a specific problem, go through the log categories mentioned above and keep an eye out for the 'Date and Time' column. If your PC froze at 11:20am, for

example, simply scroll down the list until you find the exact time and more information.

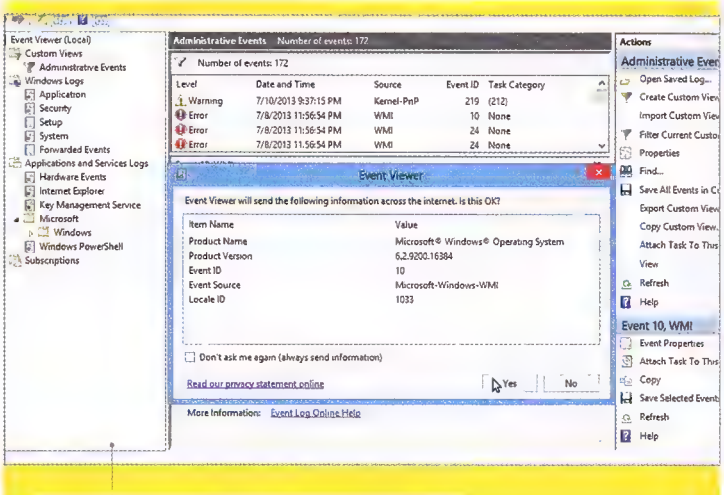
Each event is labelled one of three levels: 'Information', 'Warning' or 'Error'. You can safely ignore 'Information' events while troubleshooting, although events labelled as 'Warning' or 'Error' can often reveal clues to specific problems, so keep an eye out for them. An error message about a computer freeze will be marked 'Critical'.

In most cases, the event description recorded by Windows is very technical. Click 'Event log online help' in the bottom pane and Windows will display a list of information it will send to its online server. If that doesn't help, you can use online resources (see 'View event information online' below), which give you a more digestible form of the event log entry using bits of information from the original error message (such as its 'Event ID' and so on).

If you're sharing your computer with other users – or running it as a server that should rarely be shut off – you can enable shutdown event tracking. Once this is enabled, whenever someone shuts down or restarts the computer, they'll have to provide a specific reason for doing so. You can see each shutdown or system restart and its reason in the Event Viewer.

You can also use the Event Viewer in combination with the Task Scheduler. To access this little collaboration, just right-click any event and select 'Attach task to this event' to associate a task with the event. From then on, whenever that event occurs, Windows will perform that task automatically.

As you can see, the Event Viewer is a critical tool if you want to get to the bottom of issues with your PC. This tutorial should equip you with the skills you need to diagnose problems and find solutions.



The web can help you make sense of the reports made by Event Viewer

VIEW EVENT INFORMATION ONLINE

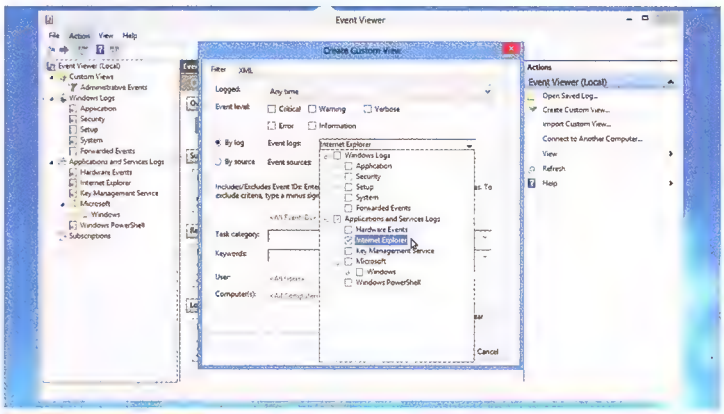
Each error entry will have an 'Event ID' and 'Source' associated with it. You can use these two pieces of information to track the error type and learn about it in more detail. They'll also come in handy if you need the help of a certified support technician.

Once you have the ID and source, head to **www.eventid.net**. The site has lots of helpful information about thousands of events. Enter the 'Event ID' number and the 'Source' in the space provided and you'll be shown a list of possible resolutions for that particular event. Most of the solutions are contributed to the web site by individuals, based on their experiences.

The site also enables you to search for solutions by entering keywords that describe the error. There's also a special search box that will let you copy and paste event log messages and search for a solution based on this information.

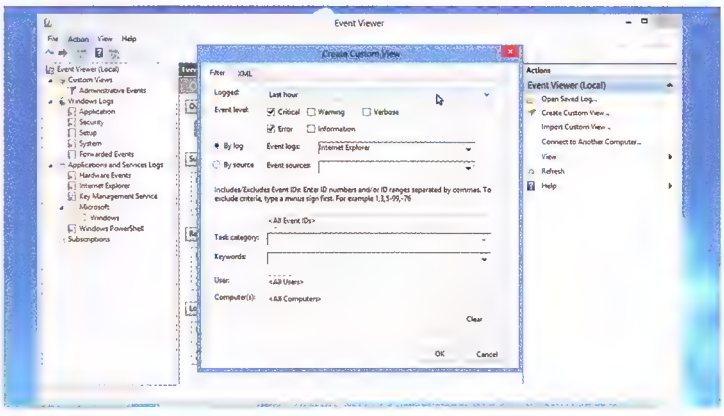
CREATE CUSTOM VIEWS

Monitor errors that need regular investigation



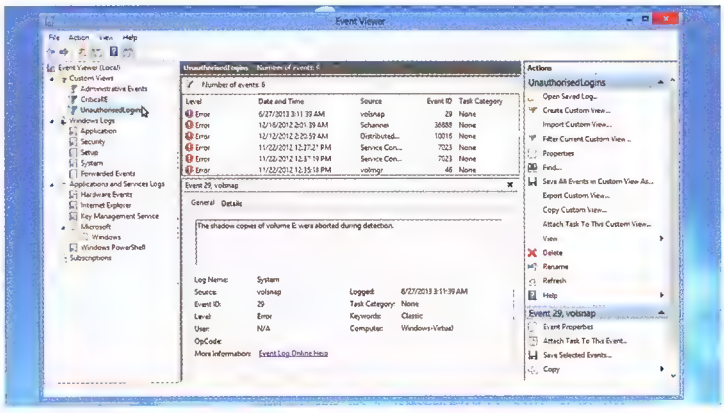
01 SELECT LOGS

Open Event Viewer, click 'Action' on the menu bar and select 'Create custom view'. You'll see the 'Event Logs' list and you can specify any logs to include in your view.



02 SELECT FILTER CRITERIA

Now select the filter criteria for your custom view. You can choose to include logs based on the time they were recorded, the event level and several other criteria.



03 READ CUSTOM VIEW

You can store your custom view in the 'Custom Views' folder. This helps you save a lot of time by filtering and displaying only the events that are important to you.

Save time with Jump Lists

Creating custom menus on your taskbar makes it easier than ever to find the files you need. Matt Hanson shows you how.

YOU'LL NEED THIS

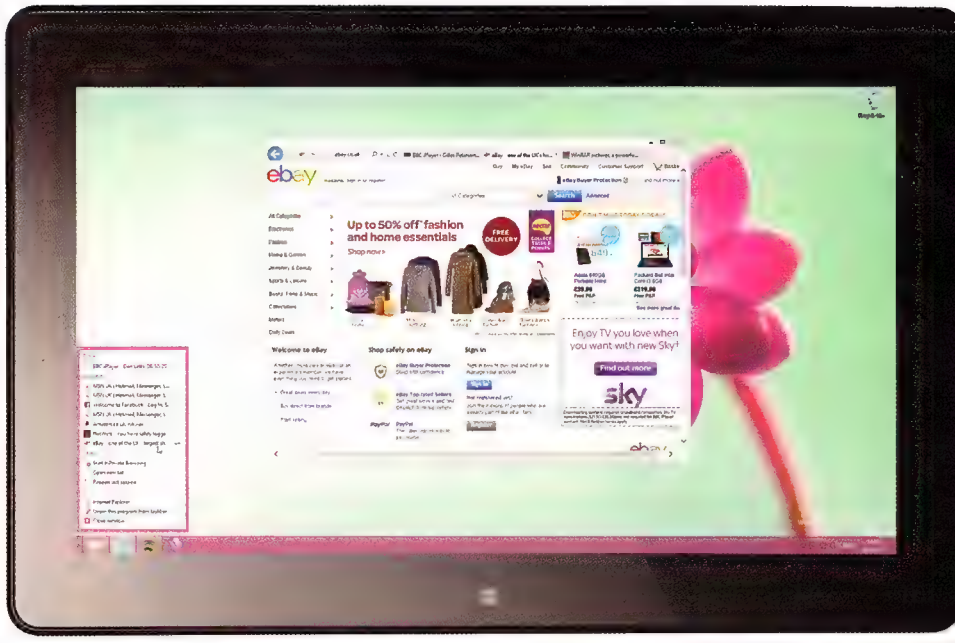
JUMPLIST-LAUNCHER

Download the program from **www.ali.dj/jumplist-launcher**.

WINRAR

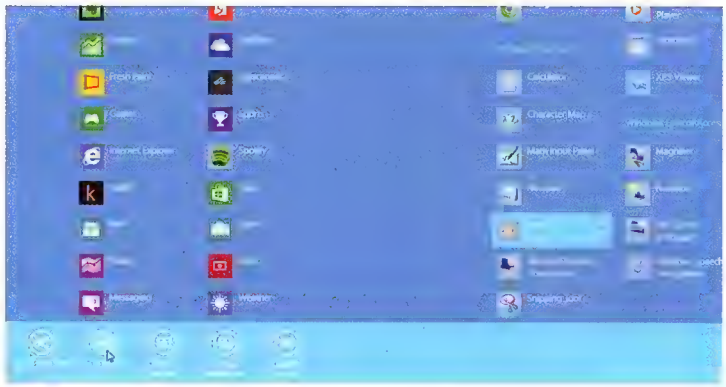
This will extract the Jumplist-Launcher RAR archive. You'll find it at **www.rarlab.com**.

Windows 8 is packed with fantastic features, but none give you as much control over your files as Jump Lists. These lists provide easy access to your most commonly used files with just a few clicks or taps, and spell the end of those frustrating trawls through all your different document folders, looking for a file that you use all the time. As well as being a brilliant way to save time, clever Windows users have found ways to exploit Jump Lists to make them even more useful. We've been playing around with Jumplist-Launcher, a free application that enables you to build custom lists.



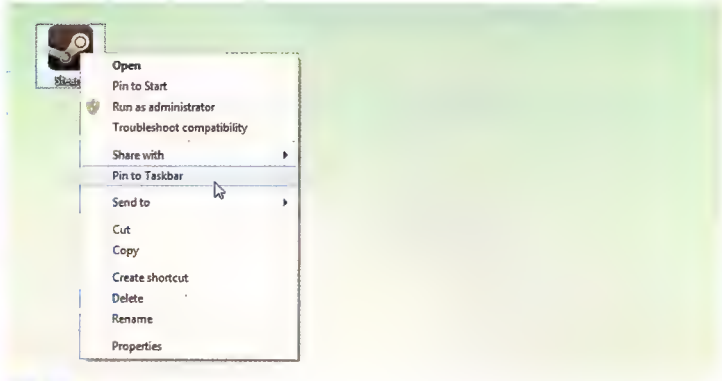
WORKING WITH JUMP LISTS

Make your life easier and save time.



01 PIN IT DOWN

Apps found on the Windows 8 'Start' screen reflect the most commonly used programs in your arsenal and it's possible to add them to your desktop taskbar in moments. Simply select one or more apps on the 'Start' screen and then right-click the bottom of the screen to activate the menu. Then, click (or tap) on the 'Pin to Taskbar' option to pin them.



02 TIDY TASKBAR

The taskbar on your Windows 8 desktop works as a handy dock for your programs and you can use it launch your favourite software. If there's a particular program you use a lot, you might want to pin it to the taskbar for quick access. Just right-click on the program's icon on your desktop and choose 'Pin to Taskbar' to put it in place. You can add as many as you like.

PIN IT

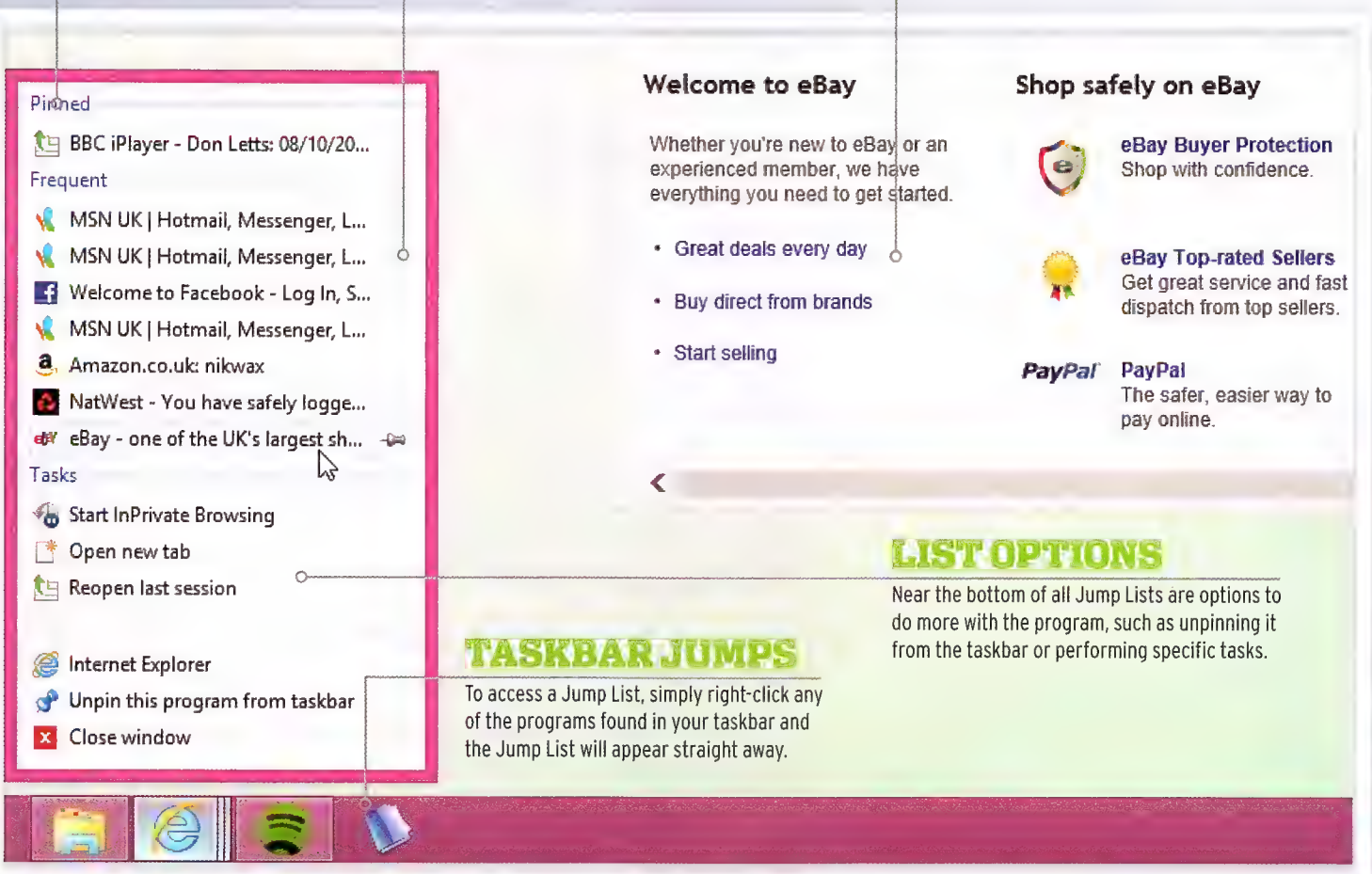
When you pin a site, it appears in the top area of the 'Jump List' menu. Just hit the pin to the right of something to pin or unpin it.

FREQUENT FILES

This area shows the items in your Jump List. In ours, you can see web sites we've visited recently using Internet Explorer.

DOING MORE

We're using Jump Lists in this example to help us do more with Internet Explorer. We can open eBay straight from the Jump List.

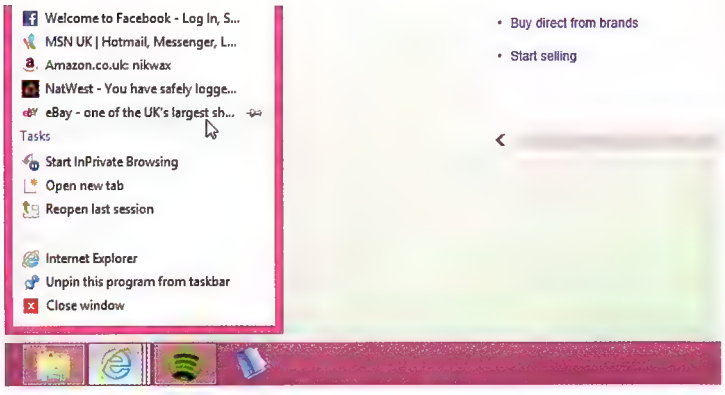

Pinned
BBC iPlayer - Don Letts: 08/10/20...
Frequent
MSN UK | Hotmail, Messenger, L...
MSN UK | Hotmail, Messenger, L...
Welcome to Facebook - Log In, S...
MSN UK | Hotmail, Messenger, L...
Amazon.co.uk: nikwax
NatWest - You have safely logge...
eBay - one of the UK's largest sh...
Tasks
Start InPrivate Browsing
Open new tab
Reopen last session
Internet Explorer
Unpin this program from taskbar
Close window
Welcome to eBay
Whether you're new to eBay or an experienced member, we have everything you need to get started.
• Great deals every day
• Buy direct from brands
• Start selling
Shop safely on eBay
eBay Buyer Protection
Shop with confidence.
eBay Top-rated Sellers
Get great service and fast dispatch from top sellers.
PayPal
The safer, easier way to pay online.

LIST OPTIONS

Near the bottom of all Jump Lists are options to do more with the program, such as unpinning it from the taskbar or performing specific tasks.

TASKBAR JUMPS

To access a Jump List, simply right-click any of the programs found in your taskbar and the Jump List will appear straight away.

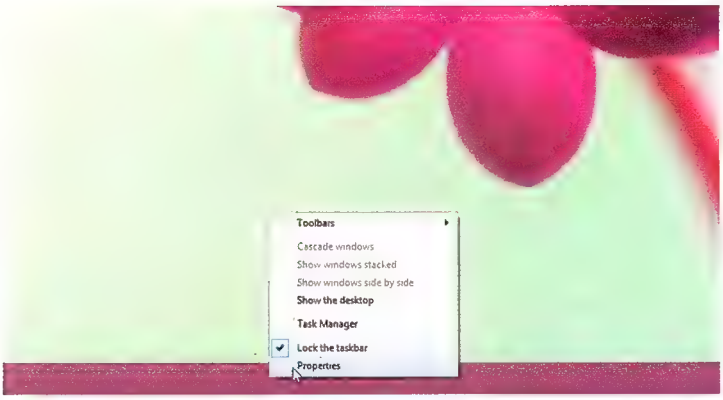

Welcome to Facebook - Log In, S...
MSN UK | Hotmail, Messenger, L...
Amazon.co.uk: nikwax
NatWest - You have safely logge...
eBay - one of the UK's largest sh...
Tasks
Start InPrivate Browsing
Open new tab
Reopen last session
Internet Explorer
Unpin this program from taskbar
Close window
• Buy direct from brands
• Start selling

03 RIGHT-CLICK TO FIND THE LIST

Many popular programs (including Windows Live, some Windows 8 apps such as Paint and a selection of third-party software) add handy extra menus known as Jump Lists to the taskbar. To access a program's Jump List, just right-click on its taskbar icon. From here, you can either open the program or choose from a list of recently opened files.

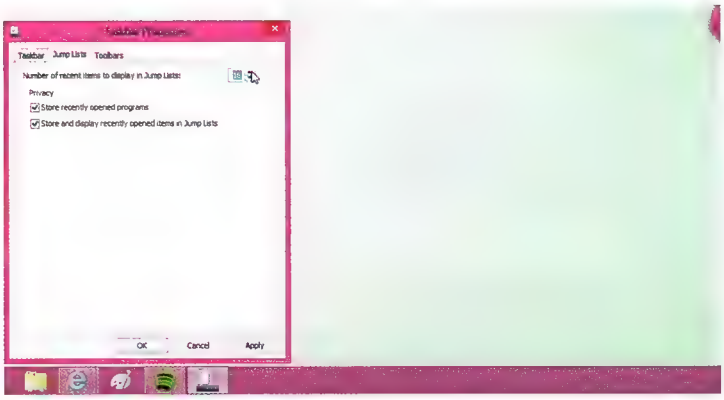
04 SAVE TIME

When you open files that are associated with a particular program on the taskbar, they appear on that program's Jump List. By default, there's room for 10 of these and they change frequently as you open more files. If you want to ensure a specific file stays on the list, it's possible to fix it in place by clicking the pin icon to the right, making it easier to find in future.



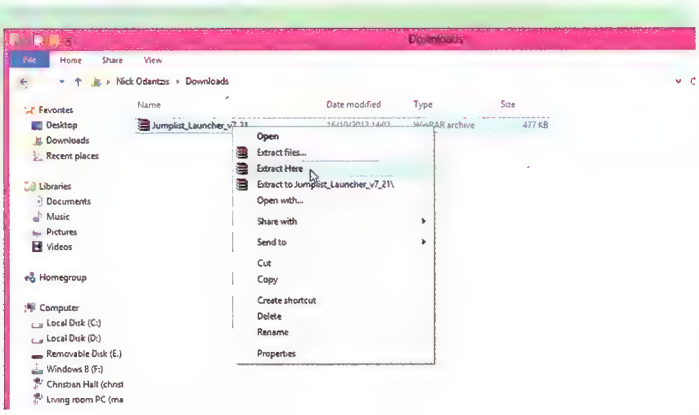
05 MORE FOR YOUR MONEY

Like so many parts of Windows 8, the 'Jump List' menus on the desktop are fully customisable. For example, you can change the size of them to suit your preferences using the 'Start' menu properties. To start adjusting your Jump Lists, just right-click the taskbar and go to 'Properties', then select the 'Start menu' tab and choose 'Customize'.



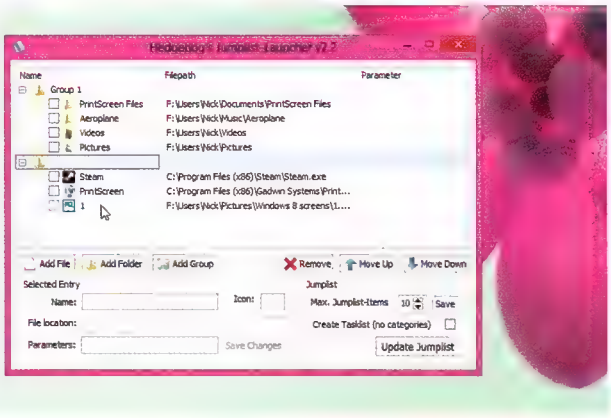
06 UP THE NUMBER

At the bottom of the 'Customize' window you'll see options that let you increase or decrease the number of entries your Jump Lists display. The default setting here is 10, but you can type in any number you wish. You can create massive lists that let you open dozens of your favourite files, or save space with minimalist access to just select a few.



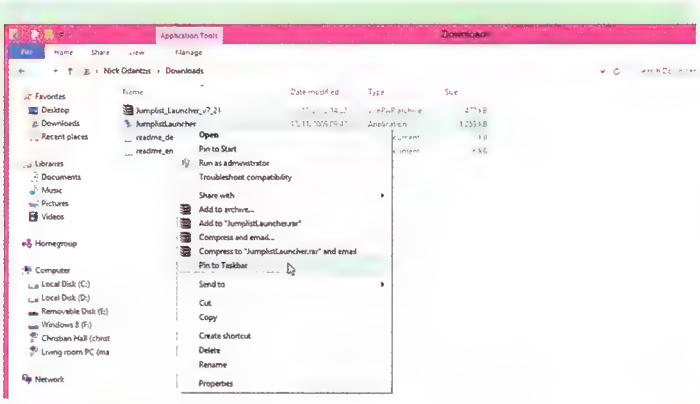
07 SET UP JUMP LISTS

If the Jump Lists in Windows 8 help you work more effectively, try Jumplist-Launcher to build custom Jump Lists, available to download from **www.ali.dj/jumplist-launcher**. To open the file you'll need WinRAR, which you can get free from **www.rarlab.com**. Click 'Downloads' and pick either the 32-bit or 64-bit version, depending on which version of Windows 8 you have.



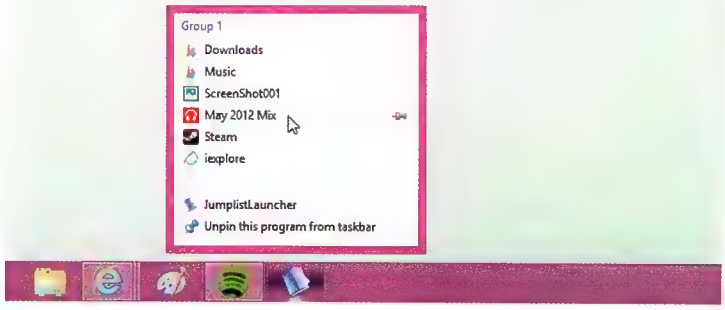
08 CUSTOMISE

Once the program has downloaded successfully, unzip Jumplist-Launcher and install it. As soon as it's set up and running, you can open it and then drag and drop files, programs or shortcuts into the main window. Once you've done this, it's easy to order your Jump Lists so they're as efficient as possible – just click the up and down arrows at the side.



09 READY WHEN YOU ARE

Once you've set up Jumplist-Launcher, you'll want it to stay on your desktop taskbar permanently, otherwise you'll be forced to reopen the program every time you restart your computer. To lock it in place, all you need to do is right-click the Jumplist-Launcher icon and select 'Pin to Taskbar'. Now it's always easy to access whenever you want it.



10 PRIMED FOR LAUNCH

Now when you start your Windows 8 device, you can just right-click on the Jumplist-Launcher icon on your taskbar to bring up the customised list you created earlier. You can pin the files and web sites on the list in place by clicking the small icons to the right of the items, just as with all your other Jump List options. You'll be amazed how much time it saves you!

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STEP-BY-STEP TRAINING

HTML

PART 13

Powerful styling with CSS selectors

In this month's HTML5 masterclass, John Allsopp explains how CSS3 advanced selectors can give you powerful ways to style your web site elements.

APC EXPERT

JOHN ALLSOPP

With a background in computer science and mathematics – and a great deal of good fortune – John Allsopp's life collided with the web in the early '90s. For nearly 20 years he has developed software for web developers, built web sites and apps, and written books, countless articles and tutorials for print and online publications. In 2000, he wrote *A Dao of Web Design*, which over a decade later continues to be widely cited as the theoretical foundation for Responsive Web Design.

The World Wide Web is revolutionary in many ways, but one of its most revolutionary aspects is largely overlooked. Typically, when we think of programming we think of `for` loops, functions and variables – something that looks like JavaScript. This approach, known as imperative programming, isn't the only one, just the most well-known. Imperative programming is about telling a computer *how* to do a task.

Wouldn't it be nice if we could tell our computer *what* we want done instead and let it worry about how to do it? This approach is known as declarative programming and it's less of a pipe dream than you might think. That's because it's precisely how CSS and some aspects of HTML5 work. This month we're going to be largely focusing on some of the more advanced aspects of CSS, which let us achieve powerful things without a variable or loop in sight.

A while back in this series, we saw how with HTML5 forms, we can use the `type` attribute of `input` elements to let the browser know what input we're expecting from the user; for example, an email address or number. Consequently, the browser knows whether the user's input is valid or not. We can combine this with CSS to style input elements with invalid content, to draw the user's attention to input that needs correcting. Here's a simple example. This is our HTML:

```
<input type='email' required>
```

And our CSS:

```
input:invalid{
        background-image: url("images/alert.png");
        background-repeat: no-repeat;
        background-position: center right
}
```

If the user doesn't provide an email address or they provide an email address that doesn't conform to the valid email pattern, our input element will be styled so as to draw their attention to this. This is a great example of declarative programming in action and if you're familiar with JavaScript, think about how much easier this is than doing it with JavaScript.

CSS provides a whole lot more than just these form-related selectors, which allow us to do things that in the past we'd have needed JavaScript to do. This month we're going to look at some of CSS's more advanced selectors.

MAKE THE MOST OF YOUR ATTRIBUTES

Beyond using the name of an element as a selector (for example, `p {color: red}`), the most commonly used CSS selectors are the `class` and `id` selectors. These select elements based on their `class` or `id` values, although elements have many attributes other than just these two: `a` elements have `href` and `img` elements have `src` , to name just a couple of potentially dozens.

CSS2 introduced attribute selectors, which allowed us to select elements based on whether they had an attribute. For example, we could select `a` elements only when they had `title` attributes, like so:

```
a[title] {}
```

We can also select elements based on the value of an attribute. Here, we can select an `img` element with a specific `src` value. This will select only images with precisely this `src` attribute value:

```
img[src='http://webdirections.org/logo.png'] {}
```

As you might guess, CSS2 attribute selectors were of limited value, but with CSS3, they really come into their own. We can now select elements based on *part* of their attribute value in three different ways:

- We can select an element based on the *start* of its attribute value. For example, we'd select all links using absolute URLs with `a[href^='http://']` .
- We can select an element based on the *end* of its attribute value. To select any link to a PDF file, we'd use `a[href$='.pdf']` .
- We can also select an element if an attribute value contains a value. Here we'll select any link where the `href` contains the string `shop` [/c]: [c] `a[href*='shop']` .

So what use are these? We might want to style links differently to give the user an indication of what to expect when they follow them. What if we added a PDF icon to link to PDF documents and some sort of indication to the user when a link leads away from our site (as Wikipedia does for links to external pages)? Below is how we can do this using these CSS3 attribute selectors.

Using attribute selectors to style links based on the `href` value.

Attribute selectors allow us to style elements based on parts of the value of specific attributes. Here for example, is a link to an external page. It has an href that starts with "http://" .

We can also style based on the last characters of an attribute. This is a link to a PDF. It has an href that ends with ".pdf" .

```
a[href$='.pdf']{
        background-image: url("images/pdf.png");
        background-repeat: no-repeat;
        background-position: center right;
        padding-right: 20px
}

a[href^='http://']{
        background-image: url("images/external.png");
        background-repeat: no-repeat;
        background-position: center right;
        padding-right: 20px
}
```

Our links will then look something like the image above.

For just about the entire history of CSS, we've been adding `class` attributes to elements as hooks for styling. Therefore in the past, we might have had something like `<a href="report.pdf" class="pdf">` . Now we can use the `href` value itself to style the element, which means less markup and fewer classes to keep track of.

THE SHAPE OF THINGS

Another overlooked yet very powerful group of CSS3 selectors are collectively known as structural selectors. These use the structure of the document itself to select elements. We've had simple structural selectors, called descendent selectors, since CSS1. These select elements descended from other elements; that is, contained within those elements.

Take the following markup as an example:

```
<h1><strong><a href="http://www.webdirections.org/">Our Awesome Website</a></strong></h1>
```

The `strong` and `a` elements are descendents of the `h1` . The `strong` is a child of the `h1` and the `a` is a child of the `strong` , while also a descendent of the `h1` element.

In CSS1 we can select elements based on the descendent relationship; for example, `h1 a {}` selects the `a` element inside the `h1` and similarly, `h1 strong {}` selects the `strong` element inside the `h1` element. However, in CSS1 there was no way to select *only* child elements; that is, elements that are contained directly within another element. CSS2 introduced the child selector to do just this. With this we can select elements only when they are directly contained within other elements. For example, while `h1 a {}` selects the anchor inside the `strong` inside the `h1` , `h1 > a {}` won't.

So far, useful, but hardly Earth-shattering. Where CSS selectors really start to shine are with what are technically known as structural pseudo-class selectors. You're already familiar with pseudo-classes, from selectors like `a:visited` . Here's what these selectors can do.

We can select an element when it's the first or last child of its parent element by appending `:first-child` or `:last-child` to a selector. We can then add a bottom border to the last paragraph of a section (when the paragraph is the last child element), like so:

```
section p:last-child {
        border-bottom: solid thin black
}
```

Another common use might be to indent only the first line of the first paragraph in a section.

```
section p:first-child {
        text-indent: 1em
}
```

You might be wondering what happens if there's a list after the last paragraph in a section, or a heading before the first paragraph. These won't select the paragraphs, will they? Indeed they won't, but for this we can use the related `first-of-type` and `last-of-type` selectors. These work very similarly, although they'll select the last paragraph in a section, even if it's followed by other sibling elements, or the first paragraph even if preceded by, say, a heading.

Perhaps my favourite selectors of all are the `nth-child` and `nth-of-type` selector. Here we use a number, such as `3` in this instance, to select the third paragraph in a section:

```
section p:nth-of-type(3) {}
```

The secret to these selectors is that they can take variables instead of (or in addition to) these number values. We'll start with two simple keyword variables: `odd` and `even` . As you might guess,

OS	Count	%
Mac OS X 10.6	507	36.16%
Windows XP	343	24.47%
Mac OS X 10.5	184	13.12%
Windows 7	145	10.34%
Windows Vista	87	6.21%
Linux	59	4.21%
Mac OS X 10.4	20	1.43%
Other	4	0.29%
Unix	0	0%

Table rows with alternate colours using just CSS structural selectors.

`nth-of-type(odd)` selects the first, third, fifth and so on element of that type in its parent element. The code `nth-of-type(even)` selects the second, fourth, sixth and so on element of that type. How might we use this? Well, a common usability pattern for tables is to give different background colours to alternate rows (this is sometimes referred to as zebra striping). One way of doing this in the past has been to assign different classes to even and odd numbered rows.

```
<tr class="odd">...</tr>
<tr class="even">...</tr>
```

However, this means additional markup for no good reason and what happens if we add a new row? We need to change the class value for every subsequent row! With `nth-of-type`, we just do this:

```
tr:nth-of-type(odd) {
        background-color: #fefefe
}

tr:nth-of-type(even) {
        background-color: #aeaeae
}
```

This will result in zebra striping for our table, no additional markup required, as you can see above.

We can take these selectors one step further still. In addition to the simple keywords `odd` and `even`, we can also use formulas to describe which elements to select. These formulas are of the format `xn + y`, where x and y are numbers. How does it work? Well, it's simpler than you might think. If you want to select every third element of a type, you'd use `nth-of-type(3n)`. What the browser does is start with `n = 0` and calculate the result (in this case, `3 x 0 = 0`), then `n = 1 (3 x 1 = 3)`, then `n = 2 (3 x 2 = 6)` and so on. In this way, we could colour the background of every third cell (the `td` element) of a table row like this:

```
td:nth-of-type(3n) {
        background-color: #fefefe
}
```

What about the other cells? Well, we can colour the first `td` element after the 3-nth `td` with the formula `3n + 1`. So, we'll add a new rule:

```
td:nth-of-type(3n + 1) {
        background-color: #aeaeae
}
```

Lastly, we'll want to select the `td` after this one. We could do that with the formula `3n + 2`, although we can also observe that this `td` is also one element before the 3-nth `td`, which means we can select it like this:

```
td:nth-of-type(3n - 1) {
        background-color: #aeaeae
}
```

Now instead of alternating table rows, we've changed the table column colours, alternating every third column. All this with absolutely no change to our markup. You can see the results of this in the image below.

A LITTLE BIT MORE

CSS3 introduces several other selectors of a more specific nature. In an earlier article in this series, we saw the `:valid` and `:invalid` selectors we can use with input elements to style elements when they have either valid or invalid input, determined by the value of the `type` attribute.

In a similar vein, there are several selectors that are related to the state of form elements, such as radio buttons and checkboxes, which we can use to style these elements. For example, we can select the following:

- An `input` when it's enabled using `input:enabled`.
- A `button` when it's disabled using `button:disabled`.
- A `checkbox` when it's checked using `input[type='checkbox']:checked` (which also shows us how we can combine attribute and other selectors).

This makes it much simpler to customise your user interface than the bad old days of needing JavaScript to detect the state and apply the style.

MORE THAN MEETS THE EYE

Web developers and designers often run off and start using frameworks and libraries, or even plain old JavaScript, when simpler tools are right at hand. So before you over-think your development, explore what the core CSS and HTML standards already allow you to do. You might be surprised at just what they enable already.

OS	Count	%
Mac OS X 10.6	507	36.16%
Windows XP	343	24.47%
Mac OS X 10.5	184	13.12%
Windows 7	145	10.34%
Windows Vista	87	6.21%
Linux	59	4.21%
Mac OS X 10.4	20	1.43%
Other	4	0.29%
Unix	0	0%

Every third column has a different background colour using only CSS selectors.

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PROJECT #10

USB foot-operated mouse switch

Darren Yates answers a reader request to design a foot-operated mouse switch to avoid RSI injuries using less than $20 worth of parts.

APC EXPERT

DARREN YATES

Darren is a multi-award-winning journalist who started building and testing computers in the early '90s. He's developed a range of PC software, including *PC User*'s UserBench benchmark series starting in 2005, its UserOS Linux distros in 2008 and is now working on new benchmarks for Android when he's not busy writing or torturing hardware with his soldering iron.

Arduino microcontrollers can easily be used to power fun projects like robots and even sending tweets to Twitter, but they're versatile enough to turn up in the strangest of places – like under your feet.

We had a question on our **apcmag.com** forum from a reader about whether it was possible to create a foot-operated mouse switch to help reduce his repetitive strain injury (RSI). He needed to do a lot of mouse work, but continually clicking and dragging with the left mouse button was causing strain. So the question was could an Arduino be programmed to provide a left mouse button click by using a foot pedal switch instead?

INTRODUCING ARDUINO MICRO

The answer is yes, it can. However, for the first time in this series, we've found something the Arduino Uno board can't do. So this month, we're introducing the Arduino Micro, a tiny microcontroller board about the size of an SD card that has all the features we need for the job. The Micro is the miniature version of the Arduino Uno follow-up called Leonardo.

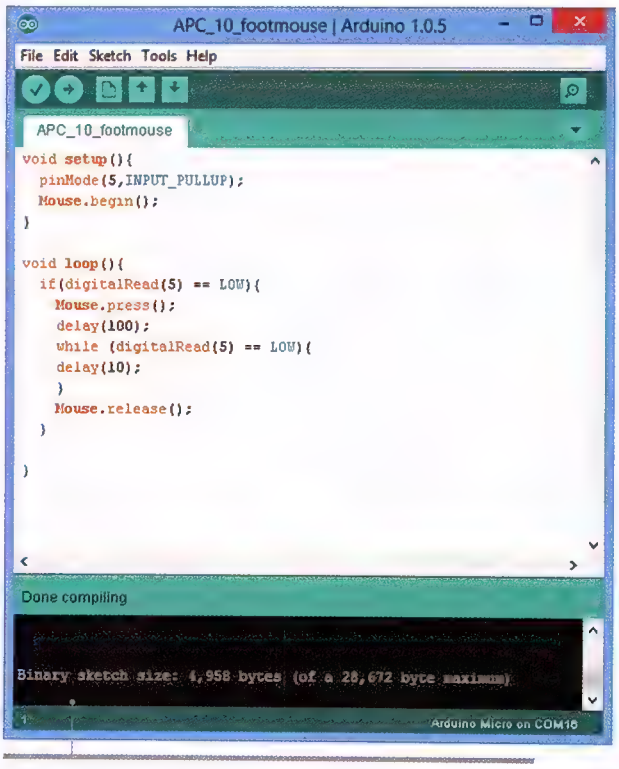
What makes the Leonardo and this tiny Arduino Micro different to the Arduino Uno we've been using up until now is a completely different CPU. Instead of the old ATMEGA328P, these newer boards use an ATMEGA32U4 microcontroller. The new chip comes with the same instruction set and 32KB of onboard flash, plus it still connects to your Arduino IDE and runs the same basic code – the difference is the ATMEGA32U4 has a built-in USB controller and an extra 512 bytes of RAM. If you've ever wanted to make a simple USB device, the Arduino Leonardo or the little Arduino Micro can make it happen.

- **Arduino Micro board:** $8.20 (**tinyurl.com/k7c5udh**)
- **Foot-switched pedal:** $2.60 (**tinyurl.com/jvuz4v3**)
- **6.35mm panel socket:** $1.95 (**tinyurl.com/la388bb**)
- **83x54x31mm clear box:** $2.95 (**tinyurl.com/m9v8msg**)
- **TOTAL: $15.70**

PARTS NEEDED

What we're building this month is essentially a foot-operated mouse button that plugs into your computer's USB port. In terms of hardware, we don't need very much – you can shrink it down to a foot-operated switch pedal, a small ABS plastic 'jiffy' box from Jaycar, a 6.5mm panel socket and the Arduino Micro board. Buy most of the parts from eBay and you can do the whole project for under $20. You'll also need a microUSB cable, although the included with your smartphone should work just fine.

The Arduino Micro is incredibly cheap and available from a number of resellers on eBay for under $9 including shipping. Just make sure it's the Arduino Micro you order and not the Arduino Nano – the Nano is a similar-sized board, but it's an Arduino Uno-era board that uses the old ATMEGA328P chip, not the ATMEGA32U4 chip we need here. At the very least, you need an Arduino Leonardo or Micro to make this project work because of the integrated USB controller.

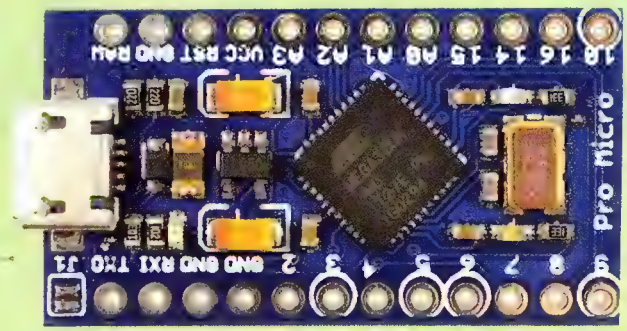


This shows the complete source code for our foot-operated mouse button.

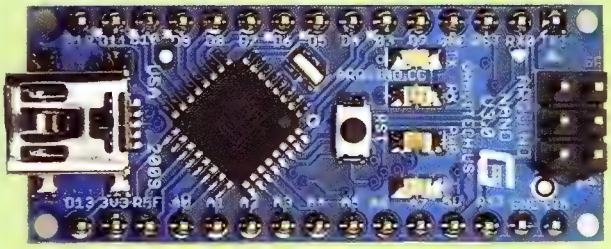
NEW ARDUINO IDE

If you haven't already, we suggest you upgrade your Arduino IDE to the latest version (at the time of writing, that was 1.0.5) to ensure you get the latest library updates. You can grab it from arduino.cc. There's also a new Windows installer option.

This $25 deluxe pedal comes with no plug, requiring some DIY. eBay sells lighter pre-plugged models for under $5.



The Arduino Micro uses the Atmel ATMEGA32U4 chip and has two rows of 13 pins.



The Arduino Nano can't be used in this project and differs with two rows of 15 pins.

This foot pedal offers NO and NC switching.

Just two wires to a 6.35mm phone socket is all the Arduino Micro needs.

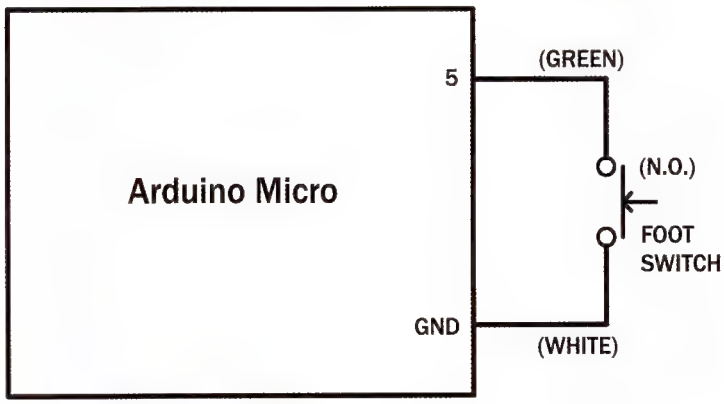
As for the foot switch, you can find plenty of these on eBay for under $3. What surprised us is that they're used in tattooing machines of all things and usually come with a 6.5mm TS (tip-sleeve) phono connector on the end, making them ideal for our needs. You'll need to also pick up a panel socket to match – you'll find these at any Jaycar store (see the parts list opposite).

In the end, time was tight so we decided to go with a deluxe foot switch from Jaycar that cost us $25. It's built like a tank and can control 220VAC at up to 10A, so it should take a good amount of wear and tear. The downside is the Jaycar one only comes with bare wire ends so you have to solder on the 6.35mm plug yourself. Doing this takes a little bit of patience so if you want a simpler option, stick with an eBay foot pedal switch.

MOUSE/KEYBOARD LIBRARY

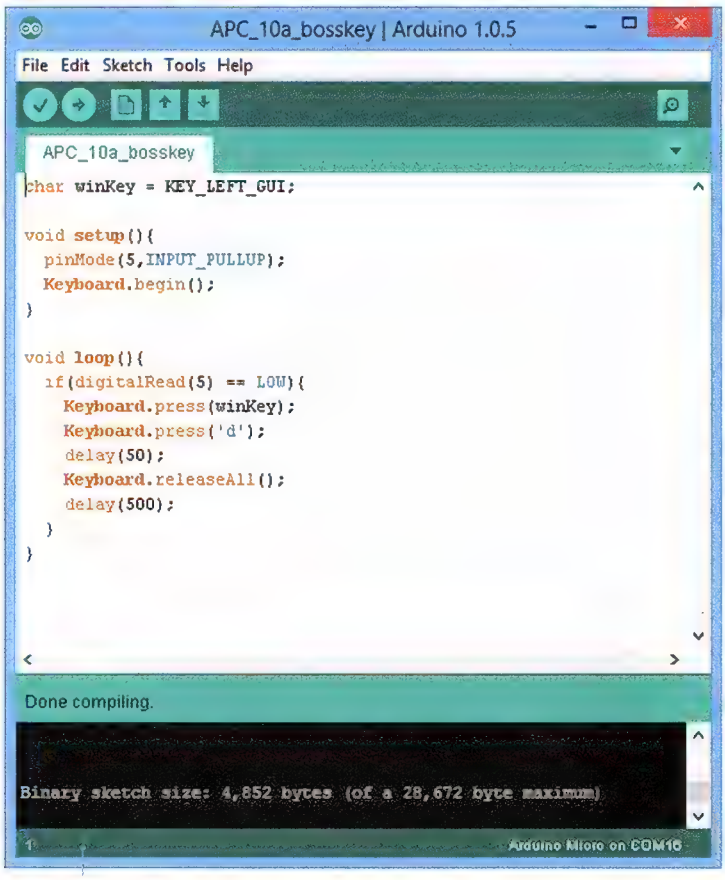
The key to this project is the built-in USB controller in the ATMEGA32U4 chip, coupled with two new libraries that come with the latest Arduino IDE: the 'Keyboard' and 'Mouse' libraries. What's clever about these is that they allow us to take control of a PC's mouse and keyboard, so you can build your own keyboard and mouse-like USB peripherals that work with any computer – not just Windows computers. The libraries are designed so that you can hack into the mouse and keyboard functions of any Windows, Linux or Mac OS X computer. Even better, apart from just the odd key map change, there's nothing you need to change in your source code to get it working on any of these OSs.

In this project, we're using the 'Mouse' library to get an Arduino Micro



apc FOOT-OPERATED MOUSE/KEYBOARD CONTROLLER

The simple circuit diagram of the Arduino Micro-powered mouse/keyboard controller.



The complete source code for our foot-operated 'show desktop' boss key.

to send left mouse button presses and clicks to the PC. As for the source code, it doesn't get much simpler.

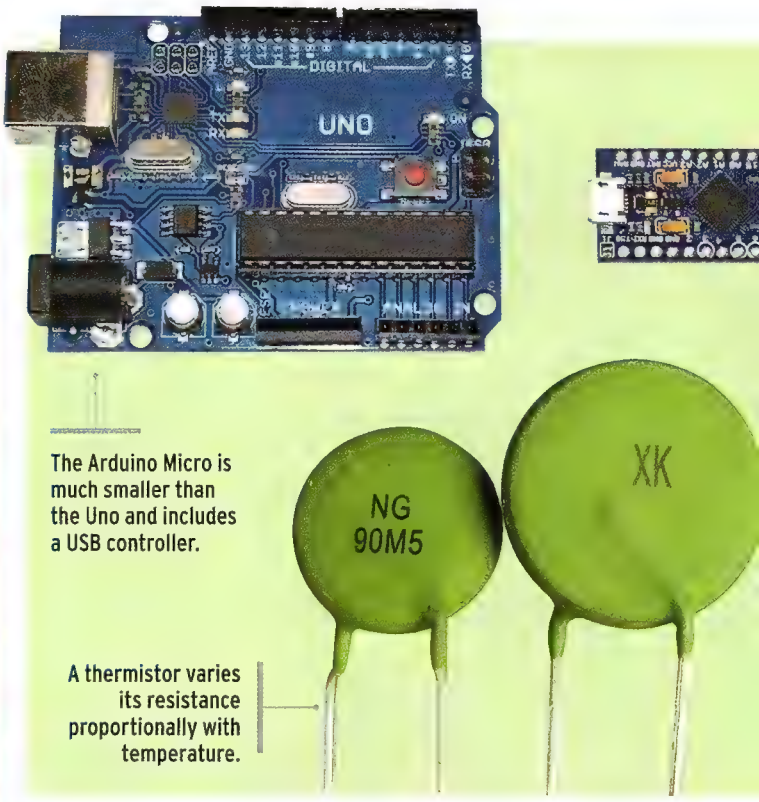
PROJECT CODE

You can download the source code from our web site at **apcmag.com/arduino.htm** as usual. However, since it's only 14 lines, here's the sketch for our foot-pedal operated mouse switch in its entirety.

```
void setup(){
  pinMode(5,INPUT_PULLUP);
  Mouse.begin();
}
void loop(){
  if(digitalRead(5) == LOW){
    Mouse.press();
    delay(100);
    while (digitalRead(5) == LOW){
      delay(10);
    }
    Mouse.release();
  }
}
```

Here's how it works. The `setup` procedure defines the Micro's digital I/O pin 5 as an input. To save ourselves having to buy a 10kΩ resistor, we're using the pull-up resistor built into that (and every) Micro I/O pin. After that, we initialise the 'Mouse' library.

We then hit the main `loop` procedure and it's pretty simple: it continuously reads the input level of pin 5 and as soon as it becomes a digital 'low' (that is, when we're pressing the switch), we send a left mouse button press to the PC and head straight into a 100-millisecond delay. Why? We're performing an exceptionally crude yet effective form of 'switch debouncing'.



The Arduino Micro is much smaller than the Uno and includes a USB controller.

A thermistor varies its resistance proportionally with temperature.

When you press a mechanical pushbutton switch like a foot pedal, it doesn't just instantly go from 'off' to 'on' or 'on' to 'off'. For a short time, it will make and lose contact hundreds of times (known as bouncing) between the two states until it settles on its new state. Our 100ms delay allows the bouncing to settle. It's a crude form of debouncing – Arduino has a more complex method at **tinyurl.com/qfzt2b**, but for simplicity, this works.

Still, if we just issued a mouse press whenever we detected pin 5 went low without debouncing, we'd end up with hundreds of mouse presses waiting in the Windows buffer. Just to prove it, take out the `delay(100);` line and see what happens.

Debouncing ensures we get just one trigger point from one foot pedal press and we do that here with a simple delay. Once the press has been detected and the 100ms delay has completed, the code goes into a loop and remains there while the input at pin 5 remains 'low' (ie. the foot switch is being pressed). As soon as you take your foot off the switch, pin 5 goes 'high', which triggers the end of the `while` loop and the sketch issues the `Mouse.release()` code, telling Windows the mouse button has been let go.

The idea here is that you can use the foot switch the same way as the left mouse button: straight click or click and drag. The proof is in the pudding – we programmed our Arduino Micro with this exact code and it worked a treat.

BUILDING THE PROJECT

If you decide to go with the Jaycar foot switch, it comes with no connector on the end and because the cable is designed to carry up to 220VAC at 10A, it's almost as thick as your little finger, which means you'll need a 6.5mm phono plug to anchor the cable into. The Jaycar foot switch has three wires creating two modes: normally open (NO) and normally closed (NC). You want the NO connection, so use the white and green wires in the cable as shown in our circuit diagram.

Soldering the wires into the solder points on the plug is a little tricky,

Soldering a phono plug can be tricky, but worth the practise.

but it's good practise if you haven't done it before. Just remember to slide the plug shroud on the cable before you start soldering and keep the soldering neat so the shroud will screw back down over the plug after you solder the cable. Once that's done, put your Arduino Micro board into a small clear plastic jiffy box.

Because the Arduino Micro is so small, there are no screw holes. The quick option for anchoring the board is to use three layers of thick double-sided tape to hold it to the case lid, with a small channel cut out on the end of the box to allow the microUSB port some air. We used some basic wood files here – anything more will cut through the ABS plastic far too quickly.

On the other side of the case, we put in the 6.5mm panel socket and soldered two wires from the socket tabs to the ground (GND) pin and pin 5 on the Arduino Micro via a couple of PCB pins. It doesn't matter which wire goes to which pin, as long as you connect that socket to these two pins. Just be careful when soldering the PCB pins to the board – don't take too long and don't use too much solder. The wire we used is just standard light-duty hook-up wire.

After that, screw the lid into the box chassis and then plug the foot switch into the box and the box into your PC's USB port with a microUSB cable. Arduino Micro boards come with a basic flashing LED sketch preinstalled, so the yellow LED should start flashing once a second as soon as it gets power.

PROGRAMMING THE MICRO

Fire up the Arduino 1.0.5 IDE and from the top menu, select 'Tools > Serial Port' and choose the COM port that matches your Arduino Micro (you'll find that Windows 7/8 automatically starts downloading the driver software for the board as soon as you plug it in). After that, select 'Tools > Board > Arduino Micro'. Now you can type in the code shown here or download the sketch from our web site. There are no libraries you need to add – everything else for this project is already included in the latest Arduino IDE. Once you've programmed the sketch in, that's it – it's good to go. The microUSB port supplies power and handles mouse button commands, just like a real mouse.

PROJECT ALTERNATIVES

What's really cool about this project is you can easily expand it, as the Arduino Micro can handle up to 16 foot pedals. It'd take a fair bit more hardware and coding than we've included here, clearly, but it's basically more of the same thing in both cases.

Controlling your PC's mouse isn't the only thing our basic project can do – it can also issue keyboard key presses. So what can you do with that? One thing we've thought of is a data logger; instead of logging data to a device, you can log text straight to a word processor or text editor. Use the Arduino Micro (or larger Leonardo) to measure inputs and based on the result, you can send key text to the keyboard, which ends up as text on your page.

Another idea from *APC* editor Dan Gardiner is a 'boss key', which automatically shows the desktop on any Windows computer.

BOSS KEY PROJECT CODE

The code for creating a 'show desktop' boss key is only slightly different from our foot-operated mouse switch. We're using exactly the same hardware and detecting when the foot switch pulls pin 5 low. As soon as it does, this time it sends the Windows key and D key presses to the PC, which activates the 'show desktop' keyboard shortcut on Windows. It even works if you're in the Windows 8 Modern UI – it'll bring you back to the traditional Windows desktop. Here's the code.

```
char winKey = KEY_LEFT_GUI;

void setup(){
  pinMode(5,INPUT_PULLUP);
  Keyboard.begin();
}

void loop(){
  if(digitalRead(5) == LOW){
    Keyboard.press(winKey);
    Keyboard.press('d');
    delay(50);
    Keyboard.releaseAll();
    delay(500);
  }
}
```

The foot pedal plugs into the Arduino case, which plugs into your PC via microUSB cable.

The 'Keyboard' library can work with basically all keys on a standard 101-key keyboard, including Ctrl, Shift and Windows keys. The first line in this code assigns the code `KEY_LEFT_GUI` to the character variable `winKey` – `KEY_LEFT_GUI` is the left Windows key, while `KEY_RIGHT_GUI` is the right Windows key. Feel free to modify the sketch to send other keyboard shortcuts or add in more foot switches and create even more shortcuts.

Better still, if you play games using keyboard commands, you can use a foot switch to activate those keys. While I haven't tried it, there's no reason why you couldn't create accelerator and brake foot pedals for your favourite car racing games. Again, because the Arduino Micro is tapping straight into the Windows mouse and keyboard APIs, your Windows apps don't need to know anything about the Arduino Micro board – it all just happens automatically.

OTHER IDEAS

How about designing and building your own mouse? Sure, you can buy them for 10c at any computer store, but the 'Mouse' library gives you the commands to control the mouse buttons as well as movement through the command `Mouse.move(xVal,yVal,wheel)`. The positions are relative to the current mouse cursor location, although you could create your own mouse that runs via a joystick or even encoded wheels.

You could even create a basic X/Y plotting device that works via inputs from two LDRs (light-dependent resistors) or thermistors, for example, and plots the relative light or temperature levels in those directions. Ultimately, you can control the mouse movement based on analogue or digital inputs connected to the Arduino Micro board. It's just limited by your imagination.

REMEMBER THIS!

The 'Mouse' and 'Keyboard' libraries literally take over the keyboard and mouse functions of your PC, so you must ensure that you release any keyboard keys or mouse buttons as soon as possible and only activate them based on some input check or change. Otherwise, you may end up locking up your computer.

FINDING MORE INFORMATION

The Arduino team has a code reference library at **tinyurl.com/lc57rog** with full details on the instructions available in both 'Keyboard' and 'Mouse' libraries, along with a few basic examples. You should find enough information there to whet your appetite.

ROM CUSTOMISATION PART 3

Customising your ROMs

Continuing his Android ROM creation masterclass, Darren Yates shows you how to add the ultimate sign of customisation: your own boot animation.

APC EXPERT

DARREN YATES

Darren is a multi-award-winning journalist who started building and testing computers in the early '90s. He's developed a range of PC software, including *PC User*'s UserBench benchmark series starting in 2005, its UserOS Linux distros in 2008 and is now working on new benchmarks for Android when he's not busy writing or torturing hardware with his soldering iron.

Look at any of the Android forums, whether it's Xda Developers (**www.xda-developers.com**) or the equally fanatical FreakTab.com aimed at mini PCs, and you'll find a kind of reverence is reserved for those who can develop a custom ROM. Flashing your Android device with CyanogenMod will get you geek status among your non-technical mates, but even those who know what an SDK is will be impressed if you can bake your own ROMs.

So far in this masterclass series, we've looked at how to create a working Linux environment within a Windows computer system through a virtual machine using the free VMware Player 5.0.2 software. We've also shown you how to take a compatible ROM and pull it apart using the free Java/Python app Android Kitchen. Last month we looked at the concept of odex and deodexed apps and ROMs, and finally, at how to give the ROM root access and install a Superuser-style root access manager.

WARNING!

Creating your own customised ROM isn't difficult to do with Android Kitchen, but if you muck it up, it can brick your phone in extreme cases. We've tried this method with no problem on our Galaxy S III smartphone; however, we're providing this information for educational purposes only. It comes with no warranty or support if you try this and brick your phone. Note, too, that flashing your phone with a custom ROM will certainly void the warranty, so do this at your own risk.

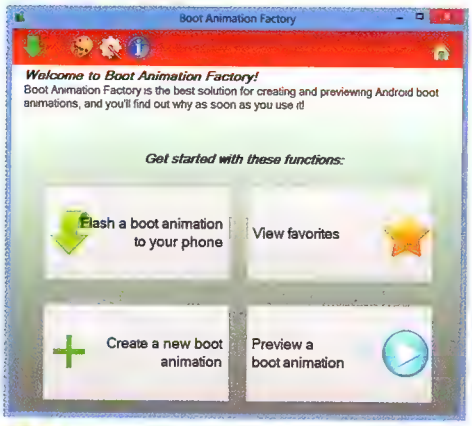
This month, we're taking a slight detour to look at one of the more glamorous parts of creating your own ROM and that's adding your own custom bootup screen animation. While there are plenty of boot animations on the web you can mod yourself, nothing says master geek more than creating your own boot animation from scratch.

MAKE A SPLASH

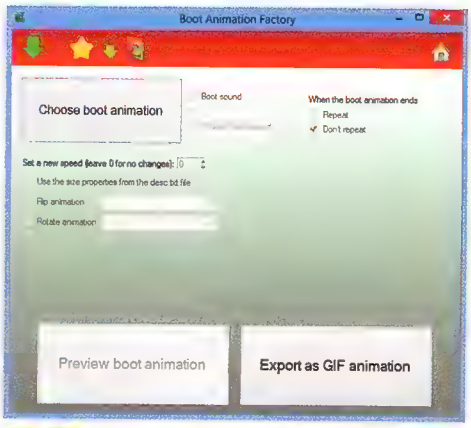
The boot animation is the video-like display you see when you first turn on your smartphone or tablet. They can be made as simple or as complicated as you like, but whether you make yours a single image or a video-quality animation like CyanogenMod, the process is still the same. And it's reasonably simple to do. At the most basic level, all you need is an image editor (anything from Windows Paint to Photoshop will work), a text editor and some creativity.

USING BOOT ANIMATION FACTORY

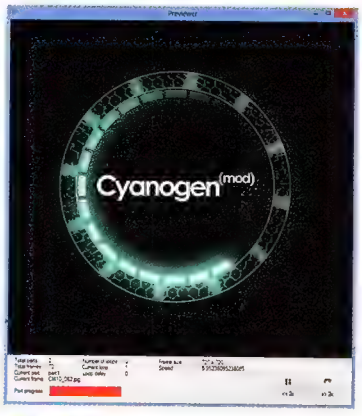
Load your finished boot animation.


Boot Animation Factory
Welcome to Boot Animation Factory!
Boot Animation Factory is the best solution for creating and previewing Android boot animations, and you'll find out why as soon as you use it!
Get started with these functions:
Flash a boot animation to your phone
View favorites
Create a new boot animation
Preview a boot animation

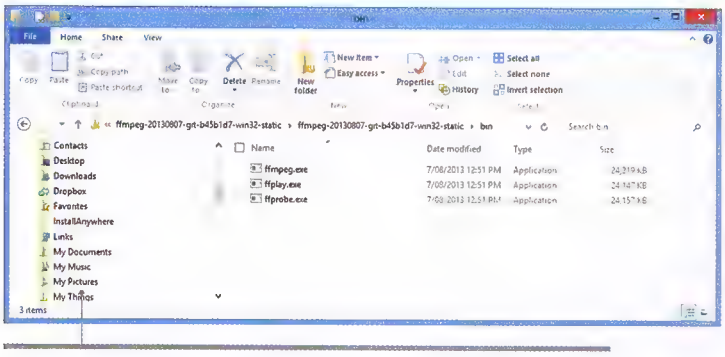
01 Grab the app from **db.tt/cYSGtjn1**, install it and run it. On the main window, click the 'Preview a boot animation' button.



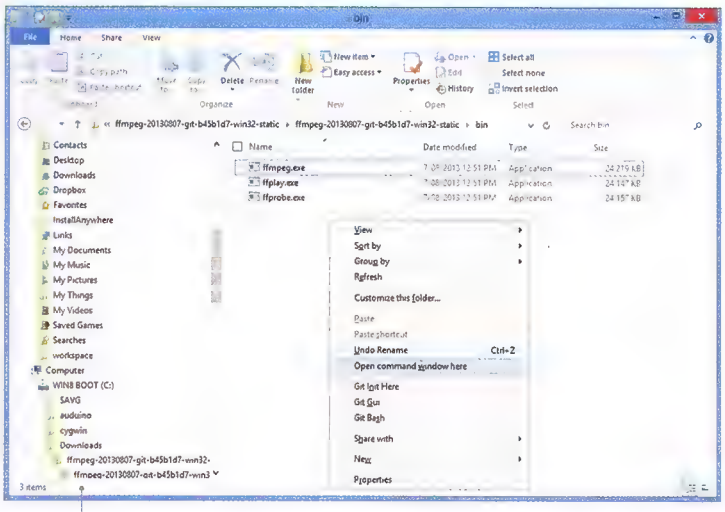
02 Click the 'Choose boot animation' button and load in the 'bootanimation.zip' file you want to check. The 'Preview boot animation' button at the bottom of the window will go live once a compatible animation ZIP is loaded.



03 Click that button and the animation should appear in its own control window, where you can set the frame speed and note the image locations.



The 'ffmpeg.exe' command line app is location in the \bin subfolder.



Hold down the Shift key, right-click and select 'Open command window here'.

HOW IT WORKS

An Android boot animation is a pretty simple affair: all it is is a ZIP file that contains a series of JPEG images in specific subfolders, which the device ROM loads and displays, as described by the text-based descriptor file.

While clever animations like the CyanogenMod splash may look like a video playing, they're just a series of discrete images being played at a set resolution and frame rate. All of this information comes from the descriptor file.

BUILD A DESCRIPTOR FILE

The descriptor file is the 'desc.txt' file in the root of the 'bootanimation.zip' file and its structure is fairly basic. The first line contains three numbers: the horizontal resolution in pixels, the vertical resolution in pixels and the image display frame rate in frames per second (fps). Let's say you're creating a boot animation for a smartphone. In that case, you'd set it up to display in portrait mode, in which case your first line would be something like this:

```
480 800 10
```

This means a 480 x 800-pixel frame size displayed at 10fps.

After that, the following lines describe the various animation sections and how they're displayed in sequence. While the frame rate is fixed by this first line, you can split your animation into sections and display each one differently – you can choose the number of times each section is played or repeated before the next section begins, you can set the delay in seconds before repeating or moving onto a new section, and you can set the subfolder location for the pics of that section.

There doesn't appear to be a limit on the number of animation sections you can have, although you don't want it to go on for two hours either. For example, the code to display three sections of animation could look like this:

```
p 1 0 part0
p 2 3 part1
p 0 0 part2
```

Decoding those lines, the first says play (p) once (1) with zero delay afterwards (0) the images in subfolder (part0). The second line says play (p) twice (2) with a three-second (3) delay after the images in subfolder (part1). And finally, the third line says play (p) repeat infinitely (0) with zero delay afterwards (0) the images in subfolder (part2).

The images in those subfolders need to be numerically sequenced; for example, 'image001.jpg', 'image002.jpg', 'image003.jpg' and so on. Make sure you include those leading zeros, otherwise you'll get strange things like 'image10.png' being played before 'image2.png'. That's because the

CONVERT VIDEOS TO IMAGES

FFmpeg is a wonderful do-all audio/video transcoding tool and it can also be used to extract images from video. Grab the latest Win32/static version from **tinyurl.com/lrcvz7k** and in the \bin folder, you'll find the 'ffmpeg.exe' command line executable. Start by opening up Windows Explorer and launching a Command Prompt within that '\bin' subfolder (hold down the Shift key, right-click in the '\bin' subfolder area and select 'Open command window here' from the context menu.) Next, use the following command line:

```
Ffmpeg –i "c:\path\to\file\video.file" –r 1 –s 480x480 –f image2 "c:\path\to\image-%3d.jpg"
```

Here's what that does:

`-r 1` tells FFmpeg to capture one frame per second of video.

`-s 480x480` tells it to create 480 x 480-pixel images from each of the captured frames.

`-f image2` tells FFmpeg to create images from each captured frame.

`image-%3d.jpg` tells it we want images stored numerically with three-digit numbers created in JPEG format.

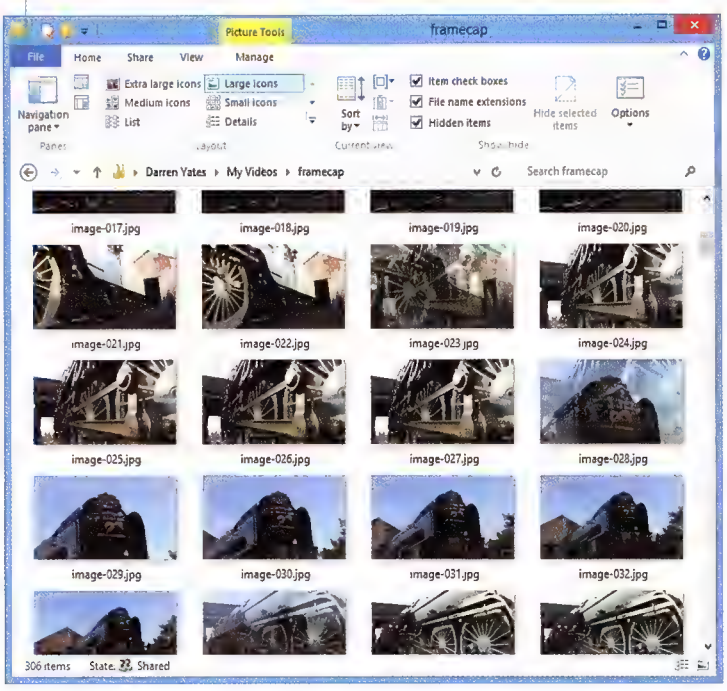
Replace `\path\to\file` paths with the appropriate paths for your files.

It's important that you include the full path to your video input file and the location where you want the images stored. If the file path includes any spaces, you must surround the whole path with double quote marks; for example: `ffmpeg –i "c:\new path\videonext.avi"`. If you don't, it won't work. Also, the save location folder path must exist already – FFmpeg won't create the folder for you and will simply fail.

The other important thing is that the frame size you select will also set the aspect ratio. For example, 480 x 480 pixels will produce square frames that will probably look a bit 'tall'. In this case, 480 x 270 or 720 x 406 would be a better option if you're using a 16:9 aspect ratio video. For 4:3 aspect video, you'd use something like 480 x 360 or 720 x 540. Just divide the horizontal resolution you want by 1.7778 to get the correct vertical resolution for 16:9 video and by 1.333 for a 4:3 video.

C:\Windows\system32\cmd.exe
C:\Downloads\ffmpeg-20130807-git-b45b1d7-win32-static\ffmpeg-20130807-git-b45b1d7-win32-static\bin>ffmpeg -i "c:\users\darren\videos\video.mp4" -r 1 -s 720x406 -f image2 "c:\users\darren\videos\framecap\image-%3d.jpg"
FFmpeg can extract frames from your videos and save them as numbered images.

The results from the FFmpeg command run on a video clip.



system is designed to logically think '1' comes before '2', even if it's meant to be '10'. The last thing is to make sure you leave an empty line at the end of the file.

How you create those images is entirely up to you. The simple, slow way is to create and save the images one by one. The alternative is to extract them from a video using a video-to-image extraction app. The command line audio/video transcoding app FFmpeg can do this (check out the 'Convert videos to images' box on page 107 for details).

While it won't necessarily work for capturing frames from videos, one tip we do recommend if you're creating animations from scratch is to follow the square frame size used by CyanogenMod. We like this option because you don't need full-screen resolution for an animation to look good, and using a square frame will allow you to still achieve a high-resolution look without needing to update more screen pixels than necessary. That cuts down on the CPU time required, ensuring your device spends most of its time loading the ROM, which is really what you want anyway. The only other thing that we think helps is if you're making an animation from scratch, start with a black background – it just looks better.

WHY MULTIPLE SECTIONS?

If you've never seen the CyanogenMod 10 splash animation, take a look at it over at **tinyurl.com/cdmlnnn**. It's a really clever, simple design, but how does it work? You can actually download this one from **tinyurl.com/ma996tj** and using 7-Zip (**7-zip.org**), decompress it and take a look. The CyanogenMod team has created numerous animation versions in that one file ranging in frame size from 240 x 240 up to 720 x 720 pixels in both vertical and horizontal aspect. Look in one of the folders, grab the specific 'bootanimation.zip' file and expand it. We grabbed the '\vertical\720\bootanimation.zip' file and inside, you'll find the 'desc.txt' descriptor file and two folders: 'part0' and 'part1'. The 'desc.txt' file looks like this:

```
720 720 24
p 1 0 part0
p 0 0 part1
```

In this case, it's a 720 x 720-pixel image set played at 24fps. The first `part0` plays once and immediately launches into the second `part1`, which it plays indefinitely until the device desktop appears. Why multiple sections? Look at the YouTube clip of the boot animation and you can see there are two distinct parts: the fade-in at the beginning and the repeated spinning loop.

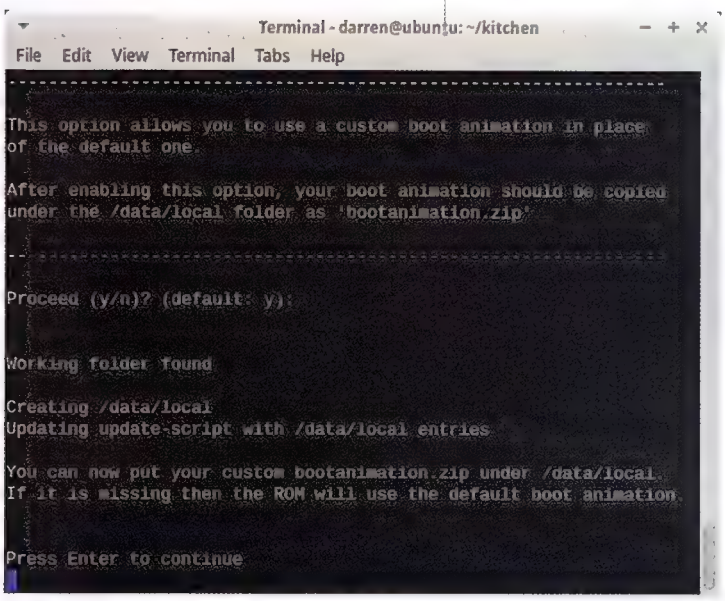
All of these images are in those folders, but rather than just looking at them individually, you can preview the whole 'bootanimation.zip' file with a specially developed app called Boot Animation Factory. This Windows app will preview the ZIP file, showing the frames and the actual image numbers and locations. You can also adjust the frame rate and watch the whole thing in slow-motion to see how it's created. It'll also build a finished ZIP file from your completed animation folders and 'desc.txt' file. Boot Animation Factory can be downloaded for free over at **db.tt/cYSGtjn1**.

The trick with any good animation loop is that the last frame in the sequence has to meet up with first. That way, it looks like a never-ending video loop, despite being made from a finite number of frames. For example, look at the three frames we've taken from the CyanogenMod boot animation below – we've included the first (048) and the last two (070, 071) from the `part1` section folder. 'CM10_071' steps nicely back into 'CM10_048' so that as the animation loops, you can't tell where it begins or ends.

The first and last two images in CM10's boot animation – the last frame loops back to the first for seamless playback.

Samsung's Galaxy S III, the phone we're using as our base in this masterclass.

Android Kitchen's boot animation option doesn't work for all ROMs, but we have a solution.

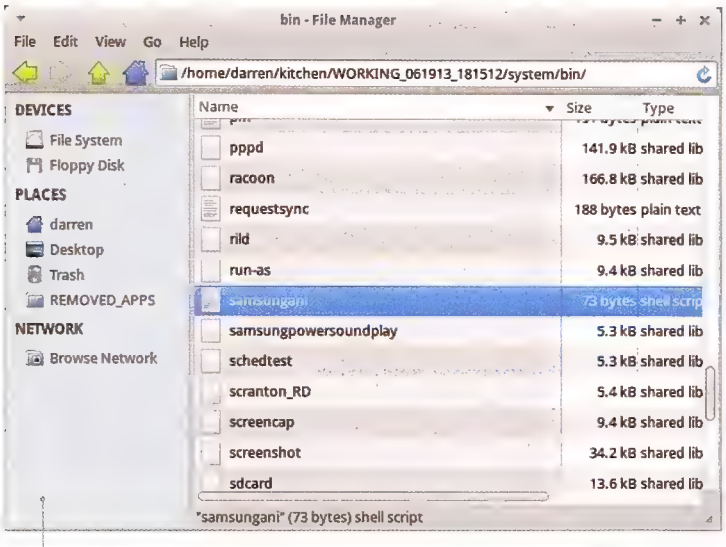

Terminal - darren@ubuntu: ~/kitchen
File Edit View Terminal Tabs Help
This option allows you to use a custom boot animation in place of the default one.
After enabling this option, your boot animation should be copied under the /data/local folder as 'bootanimation.zip'
Proceed (y/n)? (default: y):
Working folder found
Creating /data/local
Updating update-script with /data/local entries
You can now put your custom bootanimation.zip under /data/local.
If it is missing then the ROM will use the default boot animation.
Press Enter to continue

PLAYBACK SPEED

When creating your own boot animation, one of the first things to think about is how many images you'll need. Remember, it's just a splash display to give you something to look at while your phone is booting up, so you don't really want 1080p images displaying at 30fps, otherwise the phone is spending more CPU time playing an HD-grade animation, slowing down the bootup process. Also, older phones have less reserves of CPU power available to play animation, so you need to consider these things when working out how complex to make your animation.

Since the frame rate in the first line sets the playback speed, it's also the number of images you'll need for each second of play. So clearly, creating a 10fps animation takes a lot less work than a 20fps one.

But how high a frame rate for a boot animation is too high? In the end, it's not necessarily how high the frame rate is, but how many pixels your phone has to display each second, since that's what the CPU is effectively doing; for example, a 1,080 x 1,920-pixel animation at 5fps equals the same number of pixels as a 480 x 800-pixel animation at 27fps. Obviously, your device has to have a screen size that can display the whole animation frame, but overall, you want to err on the side of simplicity. This is one case where it's good to think less is more.



The new 'samsungani' and 'bootanimation' files go into the \system\bin\ subfolder of your Samsung ROM build.

COMPRESS THE FILE

The last step to making a functioning animation file is to compress the 'desc.txt' file and image subfolders into a ZIP folder. You can use 7-Zip for this, but most importantly, remember to use the 'store' option only. You don't actually want to compress anything, otherwise the ROM won't be able to open and retrieve the files. When you're done, load it into Boot Animation Factory to test that it works as you expect.

ADD YOUR ANIMATION TO THE ROM

Depending on your device, this can be complicated. Android Kitchen has an option for adding custom boot animations into your ROM. Go to the 'Main Menu' in the Kitchen, select '00' for legacy options and then '27' (add custom boot animation functionality). This will enable the ROM to look at the '\data\local' subfolder. Next, copy the 'bootanimation.zip' file into that subfolder, which should be located in 'WORKING_<date>_<day>' folder and that's it. The rest will be done when you build the ROM.

However, Samsung uses a proprietary animation system that works differently. If you're working from a stock Samsung ROM (we're using a Galaxy S III ROM in this masterclass), here's what you do.

01 Check the '\system\bin' subfolder in your 'WORKING' ROM folder and look for the files 'samsungani' and 'bootanimation'.

02 Download 'bootanimation4u.zip' from the bottom of the first post at **tinyurl.com/ncjhcwl**. Unzip it and inside the '\system\bin' subfolder of that ZIP file, you'll find replacement 'samsungani' and 'bootanimation' files. Back up the originals of these files from the 'WORKING' folder and copy these replacements over the top.

03 Grab your newly minted 'bootanimation.zip' and copy it into the '\system\media' subfolder.

04 Build your ROM.

If you look in the '\system\media' subfolder in your 'WORKING' folder, Samsung stock ROMs use a proprietary boot animation format for most things. The fix we're using here allows Android-standard 'bootanimation.zip' files to also be used again.

We tested this technique with our Samsung Galaxy S III phone, flashing a custom ROM built from a Samsung stock release with modded 'bootanimation.zip' support and it worked the first time. If you want to go back to the genuine boot animation, just replace the 'samsungani' and 'bootanimation' files you added with the originals you backed up in step 2 above.

HORROR SHOW
Some of the more fetching outfits

Saints Row IV

Welcome to Steelport, Mr President. Your hoverbike awaits...

PC | @ www.saintsrow.com | $ $60

Saints Row IV is the only game I've ever had to pause because I was laughing too much to play it. I want to tell you about the exact section that caused me to crease up and I want you to know about the other hundred-odd moments that contorted my real-life face into real-life grins or my real-life mouth into real-life laughs. I won't tell you about all of them because that would spoil them, but I want you to know because they're so gleeful, so joyful, so playful, that they turn the fourth sequel to what was an average *Grand Theft Auto* clone into one of the most fun video games I've ever played.

Saints Row IV is still set in the city of Steelport. Except it technically isn't – the game starts with an alien attack on Earth, with you as president of the US. Except it technically doesn't do that, either. The game actually starts once you've infiltrated a terrorist base to find a nuclear missile, attached yourself to the side before launch and clambered up, yanking vital bits of wiring out as Aerosmith's 'I Don't Wanna Miss A Thing' blares. The missile explodes, and you fall to Earth and crash through the ceiling of the oval office. Congratulations, you're president!

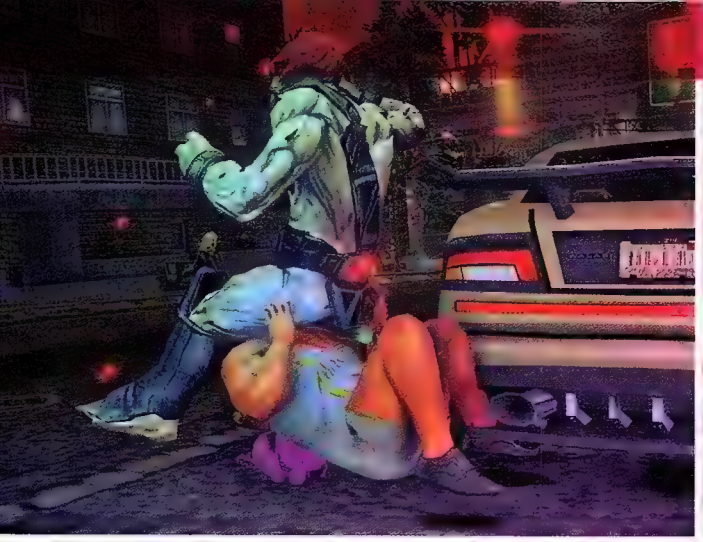
I'm including this precise description because it sets *Saints Row IV*'s tone early and better than I could with words like 'madcap' or 'anarchic' or 'what?!'. This tone continues throughout the subsequent alien invasion, throughout your incarceration in a *Matrix*-esque simulation of Steelport (see why it technically isn't the same place?) – all the way through the 10-hour campaign and 20-plus hours of side missions.

It's even present in the character creator. Long ago, we developed the concept of 'maximum face': mutants produced by pushing every slider on an avatar creation screen to full. The overweight, hollow-cheeked, elf-eared weirdo you see in these screenshots is a product of that. For the first three hours of the game, simply seeing his face kicked me into fits of giggles.

I created a monster with an aging wrestler's body, a pencil moustache and giant buggly eyes, and gave him a cockney voice pitch-shifted to 60%. He talked like Jason Statham huffing a birthday partyful of helium balloons and loomed out of the screen like a child's drawing of a nightmare made flesh. By the end of the game, I loved him. I'm not quite sure how that happened, but I think I've got an idea. *Saints Row IV* is surprisingly inclusive. It trades on ridiculousness – you can play as a toilet – but unlike *Grand Theft Auto*, it's never sneering or cruel, preferring to invite the target of its ribbing in on the joke.

Where GTA lauds movies and music as cultural touchstones, *Saints Row IV* takes on games and *Mass Effect* is one of its most visible targets. The Steelport Simulation is run by aliens: the muscular, bipedal Zin, headed by pantomime villain Zinyak. Punching out of that sim for the first time, I was given access to a ship with cabins for a crew I'd later rescue.

Saints Row IV does everything in its power to make life easy for you. I found foot power to be my favourite way of travel, but there's a full customisation system for all the cars in the game, in addition to pilotable alien hoverbikes, UFOs and attack helicopters. Any



DUDE HUGE

Half an hour into the game

I unlocked nitrous boosts – for all vehicles. My already quick cars went faster and cars in my path were destroyed by turbo-charged collisions. They felt great. An hour in, I unlocked super jumps. Holding the spacebar would power up a leap that'd get my costumed terror halfway up a tower block. It felt fantastic.

Two hours in

I unlocked super-speed. I could run faster than cars. It felt brilliant, being able to get anywhere in Steelport, across three big islands, in a minute or two. Three hours in, I'd unlocked a glide move that let me float between objectives like a disgusting flying squirrel. It felt amazing.

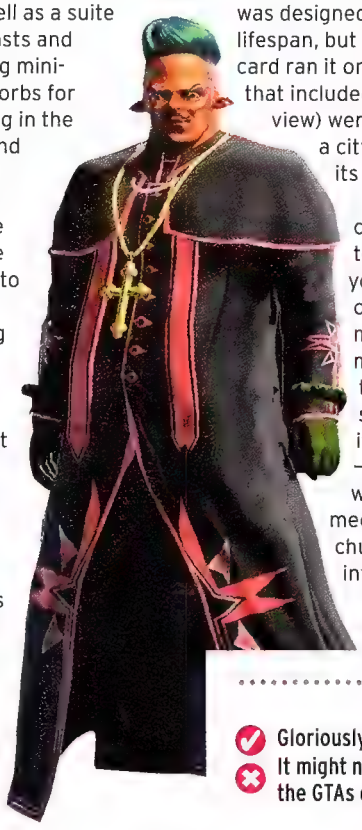
Ten hours in

I barely needed to touch the ground. My favourite way to get to a story mission marker was to begin with a long sprint to Steelport's central island, find the tallest skyscraper, bound up it while charging an upgraded tier-three superjump, before leaping off and gliding toward my objective. Fifty storeys above it, I'd hold right-click and aim the marker that appeared, turning myself into a human missile through an upgradable ability and slamming to the ground with a powerful shockwave. Pedestrians and cars would careen away from my impact point and I'd saunter the few feet to my destination in luminous pink heels. It felt glorious.

minor inconvenience was stripped away by an upgrade system ripped from console cult favourite *Crackdown*. Glowing blue collectibles hidden on buildings and bridges around the city let you upgrade your movement capabilities, as well as a suite of four powers that include ice blasts and telekinesis. I found myself entering mini-trances and collecting these blue orbs for 10 or 15 minutes at a time, revelling in the joy of superpowered movement and the camp little yelp my character produced when he collected one.

The story missions that are the strongest use characters from the three previous *Saints Row* games to make them bombastic, funny and imaginative. The simulated setting lets *Saints Row IV* play where it wants. The standout for me was a *Metal Gear Solid*-style base infiltration that forced me to shoot every light source in the facility, and the line "That light had a family". The setting also enables the game to cast its violence in an acceptable light. Enemies, pedestrians, aliens: all simulations to be suplexed onto the concrete by way of one of *Saints Row IV*'s ludicrous melee moves and left to fade into imaginary numbers.

It's not the most technically proficient game. Five or six times cut scenes failed to trigger because I was mid-animation when they were due to start, clipping was a constant problem and enemies occasionally got stuck in the scenery. Fortunately, it's not broken: Steelport, with all its moving parts, was designed to push consoles at the end of their lifespan, but my i5 CPU and two-year-old graphics card ran it on high without trouble. Graphics options that included Vsync and antialiasing (but no field of view) were more than enough to keep me happy in a city that never chugged as I glided through its skies.



Saints Row IV is a game that's comfortable with itself. It's solved how to tie callous violence to a character you actually want to inhabit by means of a narrative device, it's solved fiddly movement by an intoxicating set of movement mechanics and it's solved the leery, exploitative tone of previous sequels through genuine affection for its cast and equality in player character –man, woman or toilet, anyone can wield a giant purple dildo bat. It's a vast, mechanically joyful game, the result of chucking all the fun and freedom of gaming into the same city.

Rich McCormick

✔ Gloriously stupid and stupidly good.
✖ It might not have the polished sheen of the GTAs of the world.

8/10

ARTS AND CRAFTS

The best and worst of the *Dota 2* store.

Captain Bamboo
Just look at this little guy! I don't need to justify myself to you.

Armoured Exoskeleton
The best item sets change a hero's profile in ways that change the game.

Spoils of the Bone Ruins
The weakest item sets change a hero's profile in ways that make you say "Eh?"

Deathripper
The first *Dota* item sponsored by another game.

Dota 2

The Steam-exclusive MOBA remake has got us very excited.

PC

@ www.dota2.com $ Free with IAPs

Dota 2 is a remake of *Defense of the Ancients*, the *Warcraft III* mod that laid out the principles of levelling up a hero, pushing lanes and knocking down towers. Many of the games that followed the original sanded down its rougher edges in pursuit of new audiences or alternative business models. That's not the case here: this is the lane-pushing game in its original, most intricate form. Getting into *Dota 2* means committing time to learning a game whose mechanics have been designed for complexity rather than accessibility. It helps that it's fun.

Abilities are impactful and satisfying to land, and scale well with the ability level of the player. A suite of single-player tutorials explain the basics and Valve has done well to introduce some of *Dota 2*'s more esoteric concepts alongside the familiar business of attacking enemies, using items and deploying skills. This is followed up with a series of bot matches using a limited pool of heroes that eventually open up into full online play. However, it's inevitable that new players will feel unprepared for their first proper match: like any sport, experience is a better teacher than time spent practising in isolation.

There's something tremendously rewarding about learning to play *Dota 2*. Part of this is the vast amount of info you're asked to absorb: the abilities, items, rules, situations and solutions that constitute its secret language. Then there's the application of that knowledge, the clutch choices that determine the outcome of skirmishes, sieges and ultimately, the game. Victory feels like a genuine accomplishment in a way that it doesn't in the vast majority of other games because of the sheer number of variables in play: the best matches are like passing through a storm of chance and chaos with four other people and emerging from the other side clutching a win and, if you're lucky, a couple of new hats.

Then there's failure. Defeat is a necessary part of the equation, but it stings, and for every energising loss that teaches you something, there's a drag-out, mood-crushing face-stomp. Just as winning becomes more meaningful when you feel like the game is testing you personally, so defeat will sometimes feel like having all of your personal failures writ large.

Certainly, there will be those who make it their business to tell you that you suck. I sometimes feel like the hostility of the *Dota* community is overstated, but there's no denying that abuse occurs regularly. A mixture of competitive pressure, language barriers and anonymity create an environment where immature people feel it's acceptable to say terrible things to one another. This isn't unique to *Dota*, but it's part of the experience and it'd be completely understandable if it put you off playing the game. The point is that this negativity stems from the same forces that make the game so special: passion, expertise and personal investment. Valve has systems in place to help police behaviour, but it's an area where it could do more. You can commend or report players for a variety of respectively positive and negative behavioural traits – friendliness and leadership on one side, text abuse and intentional griefing on the other.

Commendations are listed on player profile pages as badges of honour, whereas receiving a sufficient amount of reports in a given period can result in players having their chat rights shut off for a variable amount of time. Even though the effectiveness of the system is hard to judge, it clearly hasn't been internalised by the community. It's common to see players – often the worst offenders – demanding that people be reported for simply having a bad game, while requesting commendations for themselves because they scored a lot of kills.

Dota 2 is in a strong place to be gaming right now. It's rewarding and sociable like few other games on the market, and despite its vast popularity it still feels like a secret waiting to be discovered by the masses. The next few months will be crucial for this game: it's currently the best expression of Valve's progressive attitude towards the player and if it can continue on that track, it describes a potential future for online gaming that is far more hopeful than the one we're currently playing in.

Chris Thursten

✔ A deep and rewarding game that becomes something special when taken on in the company of others.
✖ The 'community' can be unforgiving.

8/10

Shadowrun Returns

Monsters meet The Matrix.

PC

@ tinyurl.com/cc56jdc $ US$19.99

The world of *Shadowrun* is one where freelance trolls with dreadlocks punch trans-dimensional giant insects to death with their bare hands. You can't really dress it up as anything other than what it is and the same goes for *Shadowrun Returns*. It's an affectionate adaptation of the tabletop RPG, built on a low-tech engine, with a surprisingly interesting story, but not much else.

Returns is set in an alternate future in which magic returned to the world in 2012, bringing elves, witches and dragons along with it. Here, Shadowrunners are the smugglers, mercenaries, freelance ghostbusters and master hackers for hire, who make their way in between the cracks. The action takes place across an isometric world enlivened by turn-based combat and text-based dialogue trees. Thrust into this world with only a thirst for violence and disdain for authority, my character, Punchgar the Blooded, found himself wrapped up in a mystery wrapped up in a conspiracy. While the first two acts kept my attention with their sense of paranoia and slow trickle of clues, the third overstayed its welcome.

Combat is definitely a strength of *Shadowrun Returns*. With a diverse crew, any given round of combat could see you summoning a spirit, throwing a concussion grenade and unloading with machine-gun fire. All this while your Decker is in cyberspace, represented by a completely different map, trying to complete a combat mini-game. Some of the later encounters are on par with *XCOM: Enemy Unknown*'s Classic Mode. *Shadowrun*'s bang-to-buck ratio is largely going to depend on the quality of content produced by the developers and the community after release, but as it stands today, it's a mostly average RPG running in a visually underwhelming engine. Between the varied, challenging combat encounters and the somewhat above-par plot, it's worth the 20-ish hours it will take to complete. Like the life of a Shadowrunner, it drags in places and shines in others.

TJ Hafer

- ✓ An enjoyable, tactical RPG with just enough intrigue to keep you invested, impressive game editor.
- ✗ A tad over-simplistic.

8/10

Pikmin 3

Cute but tough.

WII U

@ www.nintendo.com $ $79.95

Pikmin 3 involves a lot of strategy, a bit of light humour and a lot of amassing plant-like forces as you take control of three space adventurers seeking food for their famished planet. Upon landing, you're introduced to the eponymous Pikmin who, like the previous games, are tiny plantlike dudes with a variety of handy powers that are yours to command. What follows is a strategy title where you're tasked with exploring the world and ultimately conquering it against a strict daily time limit. Each Pikmin type has unique powers, with heavy Rock Pikmin and flying Winged Pikmin joining in your cause.

Alongside the single-player campaign, there's also multiplayer co-operative and competitive challenges to play. These are great fun, but they're single-screen only, with no online component. Given *Pikmin*'s cute and friendly nature, we can't quite decide if that's really a problem. It's playable with the Gamepad or WiiMote; while the Gamepad gives you map controls, it's plagued with less responsive pointer controls, making some battles harder than they should be.

Pikmin is Nintendo's 'cute' strategy franchise, but unlike Nintendo's other well-known properties, it's one that it's only used very sparingly, which is why this is only the third full outing for these tiny plant-like warriors in a decade. The only real issue here is that like a lot of Nintendo's output, it's a case of refining a formula rather than innovating, which means that *Pikmin 3* is very much like its predecessors. If you've played the previous games you'll warm to its charm, but at the same time it'll all feel rather familiar, albeit superbly realised.

Alex Kidman

- ✓ Evolving strategy, multiplayer works well.
- ✗ Very similar to previous titles, no online mulitplayer.

10/10

CHIEF CONCERNS

Halo: Spartan Assault is as muddled as its host operating system.

@ apps.microsoft.com
$ $6.99 with IAP

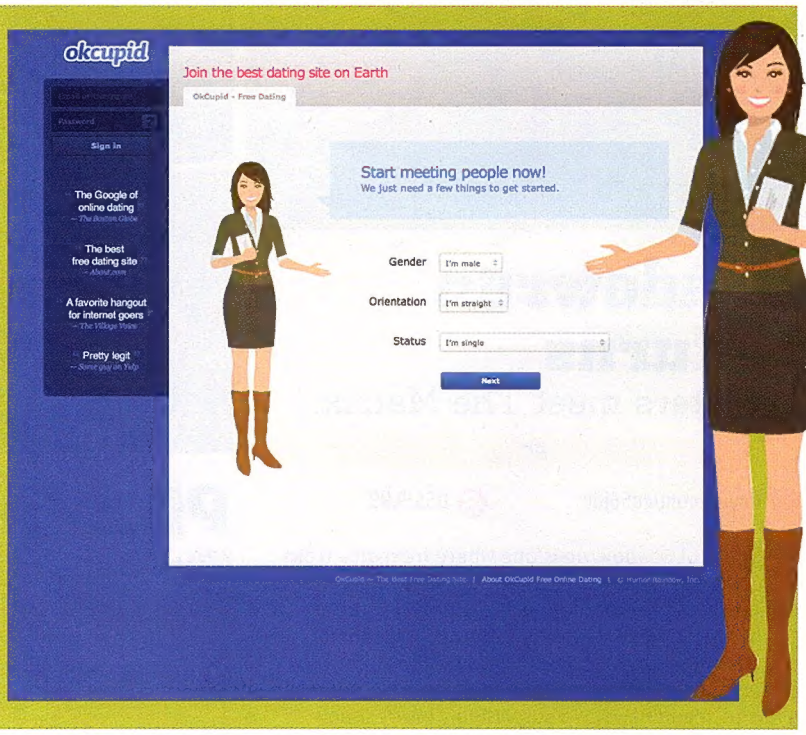
This is recognisably *Halo*, even if it's not quite the return of Master Chief forecast by students of the Steam database. Even from high up in the sky you can tell those are Covenant enemies running around down there, both in look and feel: Grunts happily waddle into your line of fire, while Elites smartly fall back behind cover when you deplete their shields. You do the same, naturally, and there's a familiar rhythm to combat as you flank round to open up enemies behind cover, retreating only when a pulsating sound effect and throbbing red energy bar alert you to your diminished defences. The story tells of two Spartans seeking to fend off the latest Covenant advance across 25 protect, escort and destroy missions. *Spartan Assault* on Windows 8 is a confused thing, so it's little surprise to find that *Halo: Spartan Assault* is, too. It's been designed to work on smartphones, tablets and PCs, but doesn't entirely convince on any of them. PC users are spared the touchscreen version's virtual controls, but it's impossible to escape the feeling that you're playing a top-down twin-stick shooter that doesn't support twin sticks. Controller support is promised, but its absence is keenly felt, especially when you hop in one of *Spartan Assault*'s vehicles and find it can only move in eight directions.

NB

PETER DOCKRILL

DATING THE ENEMY

OK. So, there's regular stupid and then there's OkCupid stupid. Not that we've got anything against online dating in general (hey, whatever works, folks!) nor this particular operator, which in recent times seems to have snared some pretty positive results for a few of the writer's personal friends, but come on! Recent reports online have highlighted just how easy it is to log into an OkCupid user's account due to the 'login instantly' hyperlinks the company sends out in emails to its users. All anyone has to do to is click on one of those links (in a forwarded email, for example) or 'brute force' their way onto the site by randomising URLs and you've got full access to an unlucky online dater's account, inbox, messages, favourites, you name it – all without needing to enter a single password. Security-conscious online daters may want to consider breaking up with the (otherwise tech-savvy) site until this rather serious-sounding flaw gets fixed, but don't hold your breath on that count: it seems OkCupid users have been complaining about this particular security loophole online since sometime back in 2009...



CAN'T TAKE MY EYES OFF OF YOU...

Eye-tracking technology might be relatively new, but early adopters like Samsung are keen to promote the user benefits with concepts like 'Smart Scroll' and 'Smart Pause', which help Galaxy S4 users control their devices with their gaze. To be fair, the implementations need a little work, although it's still early days. So what if the same technology was used not so much for your benefit, but for somebody else's? For example, to help your employer or educational institution monitor your progress or engagement. Online training company Mindflash recently announced its creepy new Focus Assist software, which "monitors trainee attention and pauses a training course [when] trainees look away. Organizations concerned about trainee distraction and compliance during self-paced remote training can now have greater confidence that critical information is being reviewed and understood." Hmm... can Focus Assist recognise when 'engaged' and 'compliant' users are giving it the evil eye, we wonder?

HOW TO MAKE APPS AND INFLUENCE PEOPLE

Truly, app developers are the new rock stars. Whereas once upon a time you'd assemble a few mates, instruments and amps in the garage to try your hand at conquering the world, the equivalent daydream in 2013 seems to be the quest to become the hottest mobile app startup on the planet. If only there was a guidebook on how to actually become the next Facebook, Google or Twitter. Well as luck would have it, startup incubator Y Combinator has been circulating an online list of the 57 best lessons for startups (**tinyurl.com/k47lgnd**), but just don't expect success to come easily. Some salient examples of startup wisdom include: "Fire people that cause too much friction", "Most investor advice isn't very good for building a magical product", "Empirically, you can only pivot so far" and "Selling a product no one wants is an unpleasant game of numbers". Jeez, good luck following all that. And hey, if it doesn't work out, you could always learn guitar.

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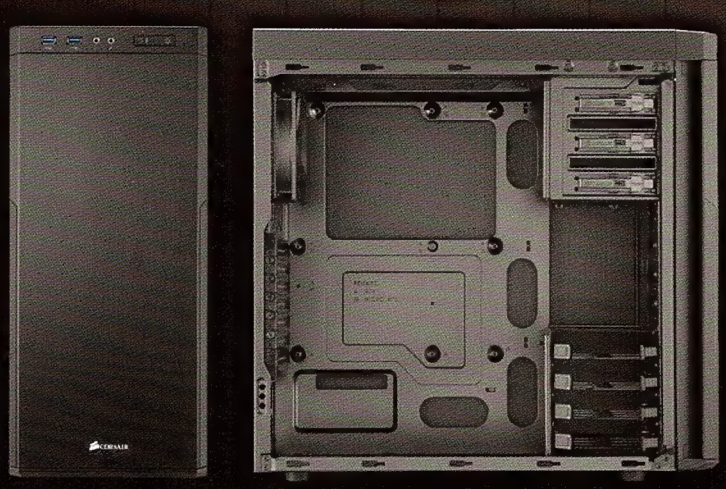

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